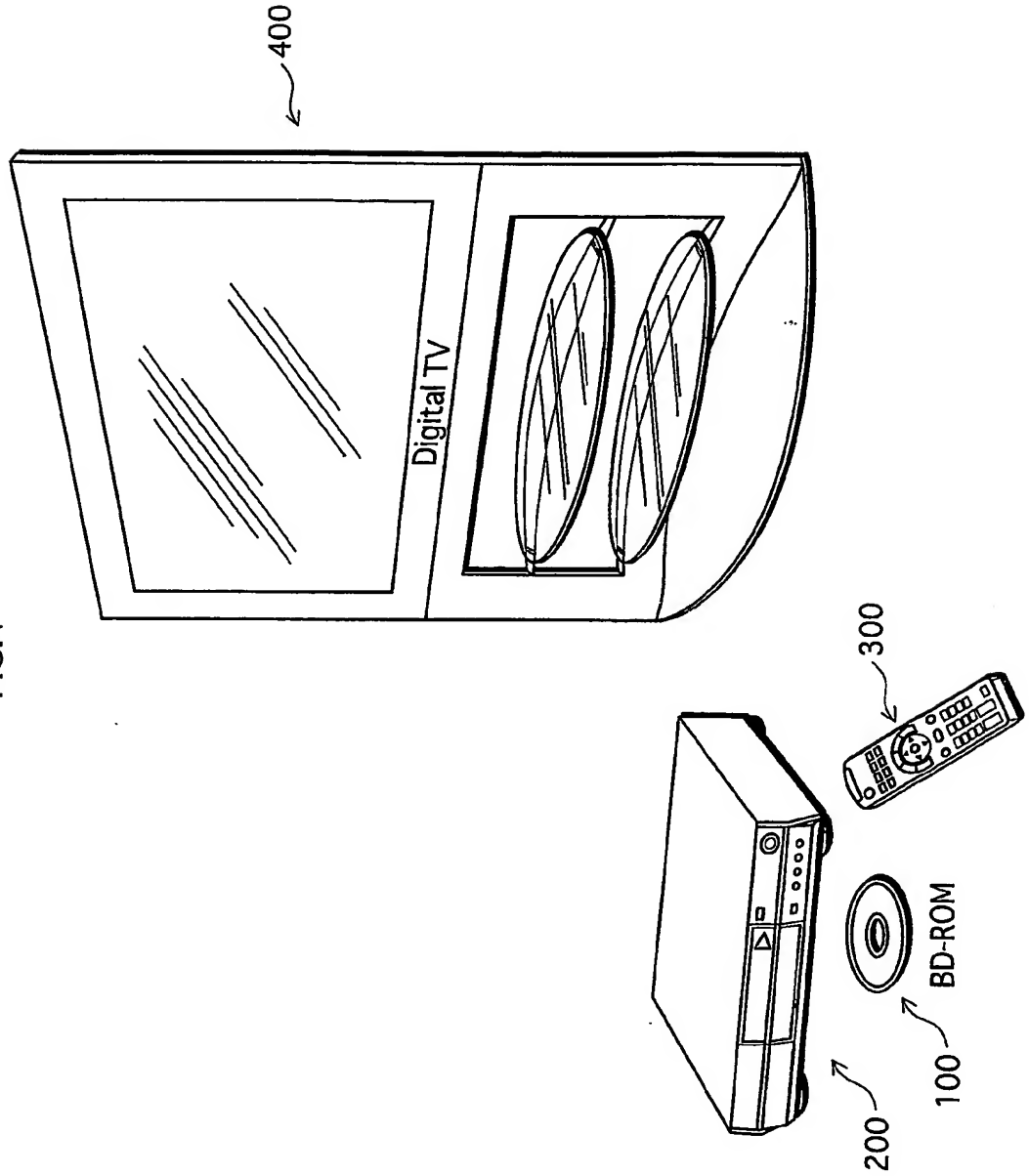
FIG. 1



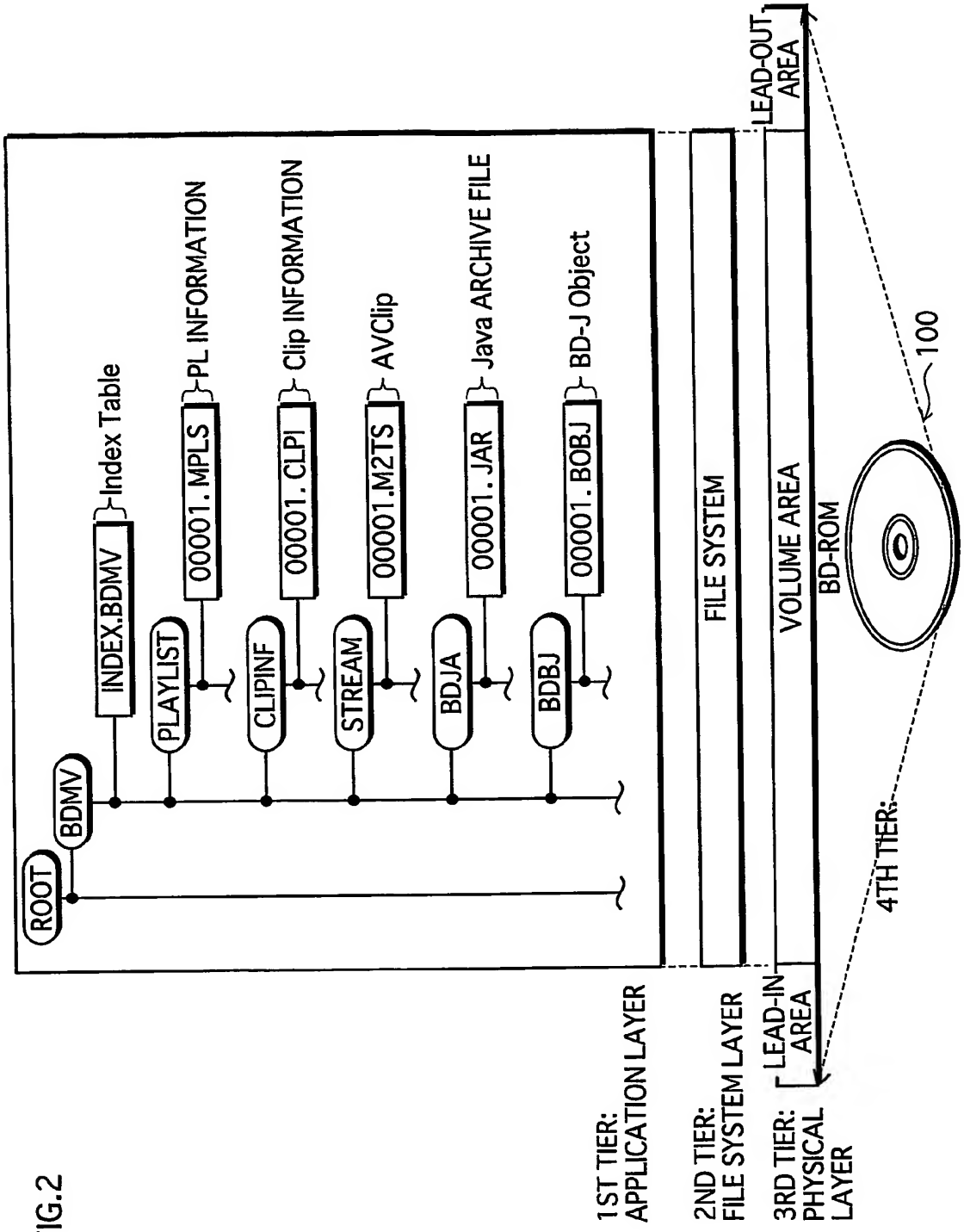

ROOT
BDMV
INDEX.BDMV
Index Table
PLAYLIST
00001.MPLS
PL INFORMATION
CLIPINF
00001.CLPI
Clip INFORMATION
STREAM
00001.M2TS
AVClip
BDJA
00001.JAR
Java ARCHIVE FILE
BDBJ
00001.BOBJ
BD-J Object
1ST TIER: APPLICATION LAYER
FILE SYSTEM
2ND TIER: FILE SYSTEM LAYER
LEAD-IN AREA
VOLUME AREA
LEAD-OUT AREA
3RD TIER: PHYSICAL LAYER
BD-ROM
4TH TIER:
100

FIG.2

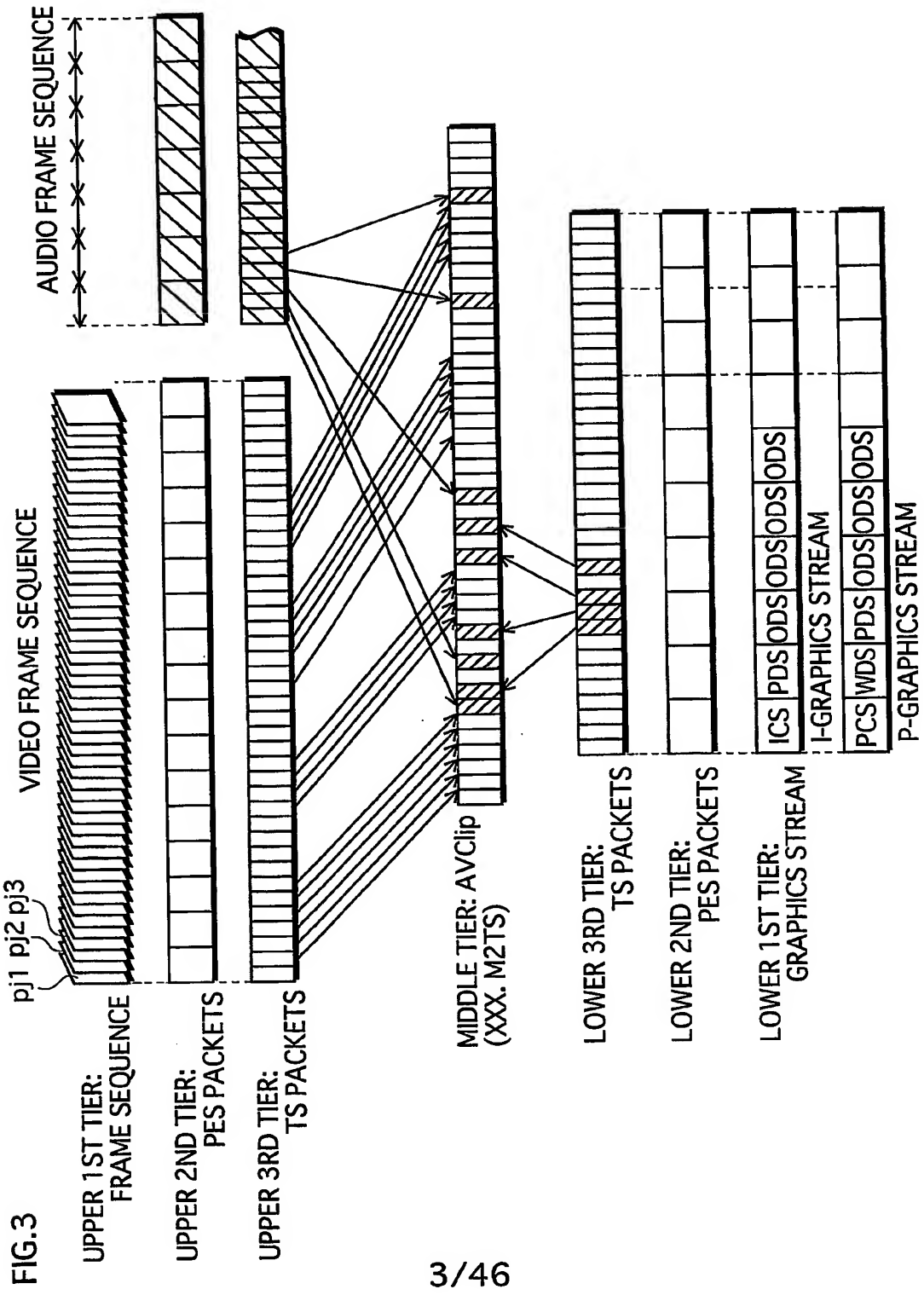

AUDIO FRAME SEQUENCE
VIDEO FRAME SEQUENCE
pj1 pj2 pj3
UPPER 1ST TIER: FRAME SEQUENCE
UPPER 2ND TIER: PES PACKETS
UPPER 3RD TIER: TS PACKETS
MIDDLE TIER: AVClip (XXX. M2TS)
LOWER 3RD TIER: TS PACKETS
LOWER 2ND TIER: PES PACKETS
LOWER 1ST TIER: GRAPHICS STREAM
ICS PDS ODS ODS ODS ODS
I-GRAPHICS STREAM
PCS WDS PDS ODS ODS ODS
P-GRAPHICS STREAM

FIG.3

FIG.4

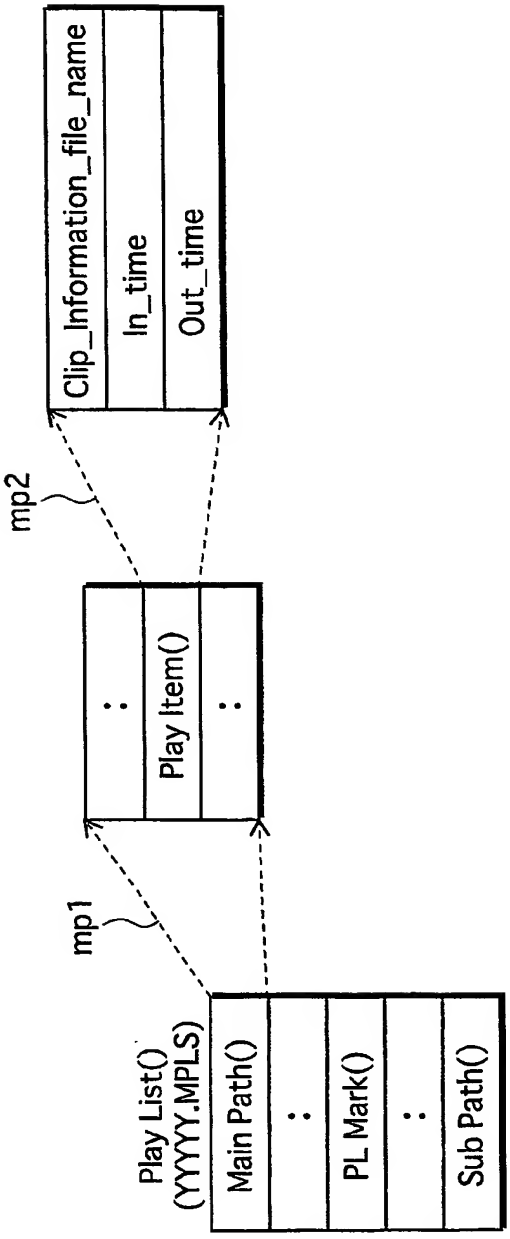

Clip_Information_file_name
In_time
Out_time
mp2
:
Play Item()
:
mp1
Play List()
(YYYY.MPLS)
Main Path()
:
PL Mark()
:
Sub Path()

FIG.5

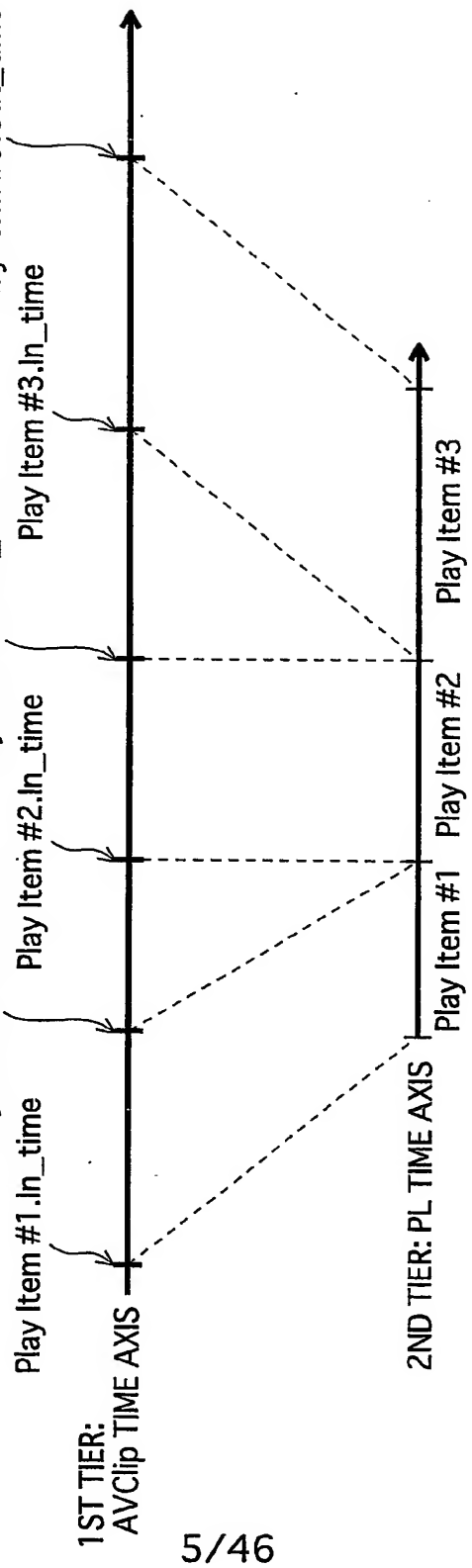

Play Item #1.In_time
Play Item #1.Out_time
Play Item #2.In_time
Play Item #2.Out_time
Play Item #3.In_time
Play Item #3.Out_time
1ST TIER:
AVClip TIME AXIS
Play Item #1
Play Item #2
Play Item #3
2ND TIER: PL TIME AXIS

FIG.6

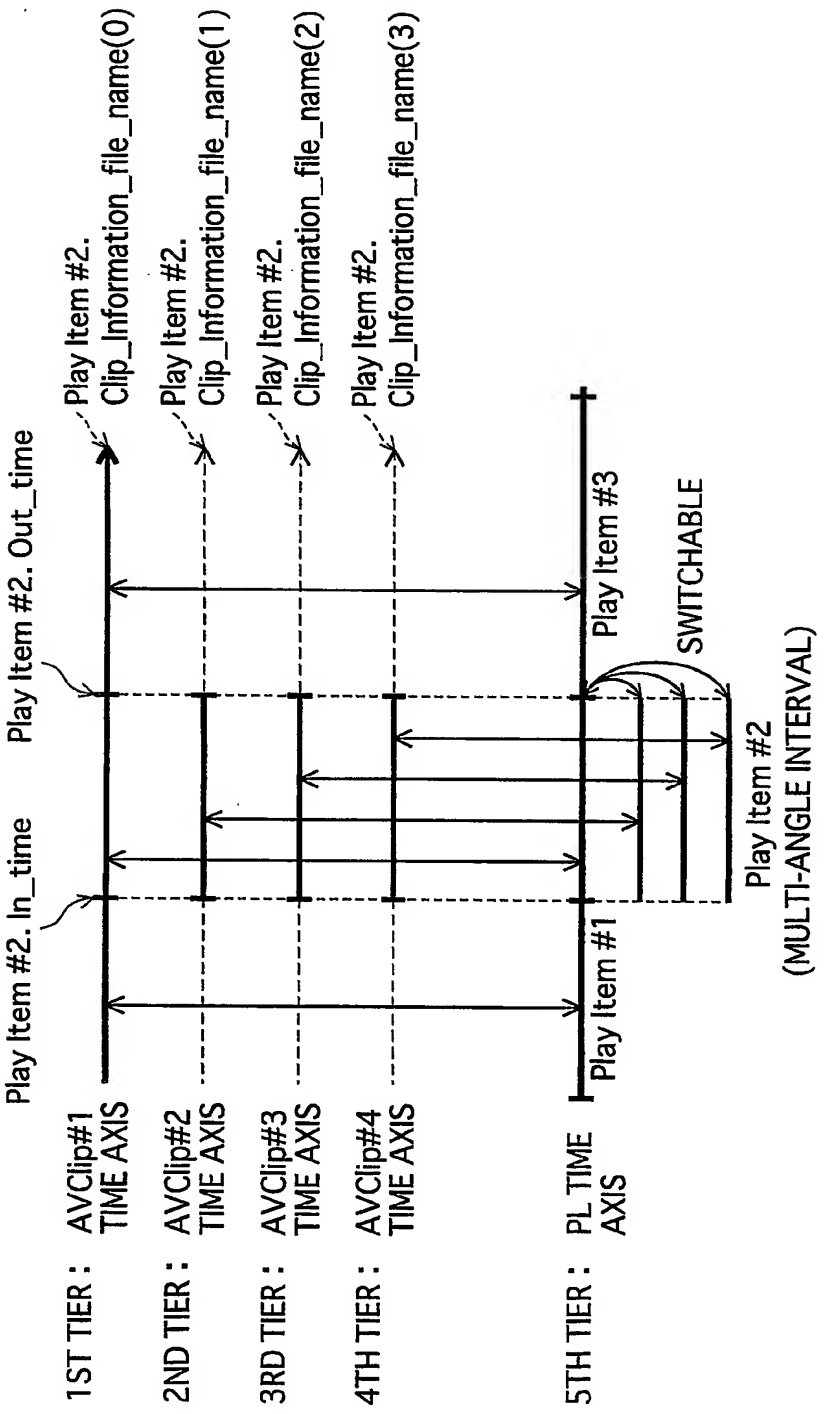

1ST TIER :
AVClip#1 TIME AXIS
2ND TIER :
AVClip#2 TIME AXIS
3RD TIER :
AVClip#3 TIME AXIS
4TH TIER :
AVClip#4 TIME AXIS
5TH TIER :
PL TIME AXIS
Play Item #2. In_time
Play Item #2. Out_time
Play Item #2. Clip_Information_file_name(0)
Play Item #2. Clip_Information_file_name(1)
Play Item #2. Clip_Information_file_name(2)
Play Item #2. Clip_Information_file_name(3)
Play Item #1
Play Item #3
SWITCHABLE
Play Item #2 (MULTI-ANGLE INTERVAL)

FIG.7

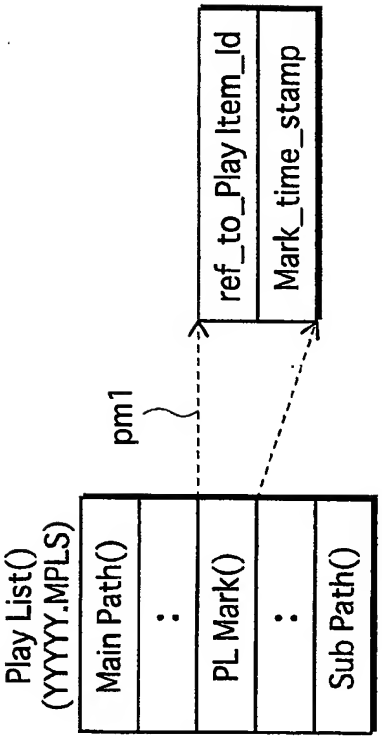

Play List()
(YYYY.MPLS)
Main Path()
:
PL Mark()
:
Sub Path()
pm1
ref_to_Play Item_Id
Mark_time_stamp

FIG.8

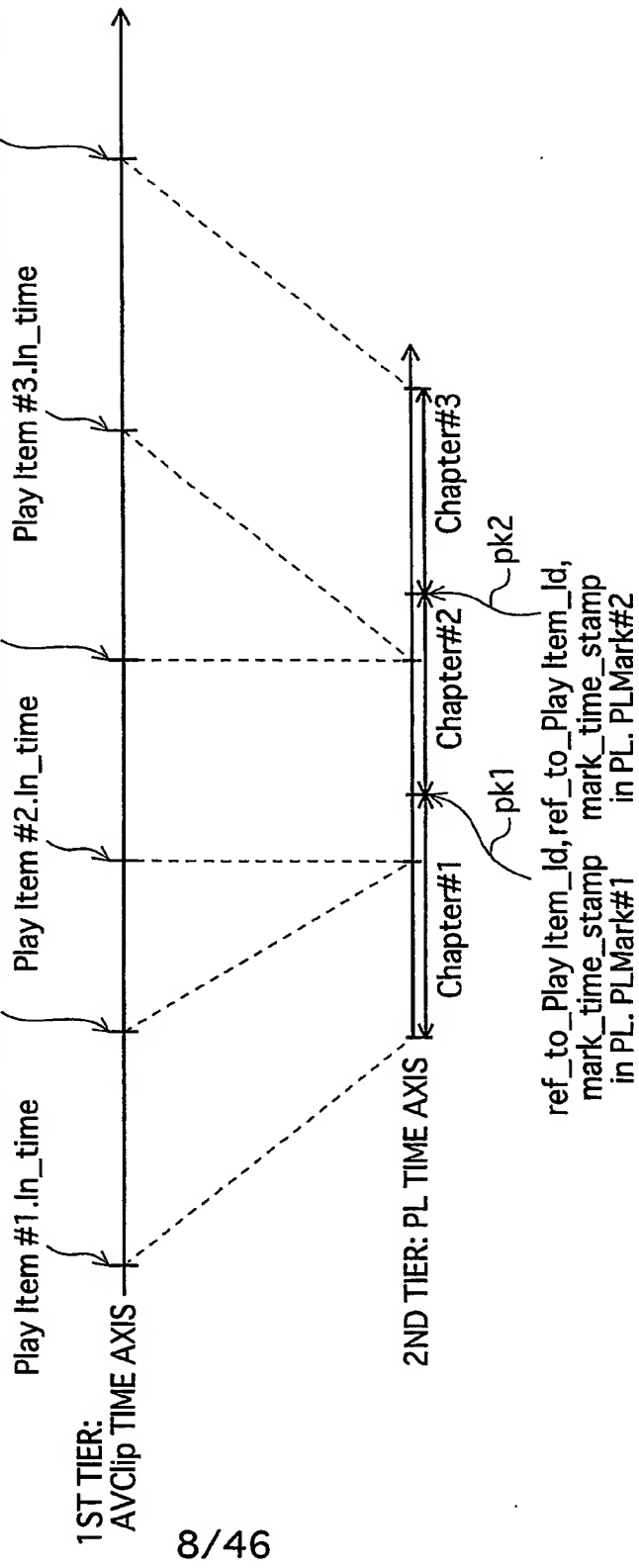

1ST TIER:
AVClip TIME AXIS
Play Item #1.In_time
Play Item #1.Out_time
Play Item #2.In_time
Play Item #2.Out_time
Play Item #3.In_time
Play Item #3.Out_time
2ND TIER: PL TIME AXIS
Chapter#1
Chapter#2
Chapter#3
pk1
pk2
ref_to_Play Item_Id,
mark_time_stamp
in PL. PLMark#1
ref_to_Play Item_Id,
mark_time_stamp
in PL. PLMark#2

FIG.9

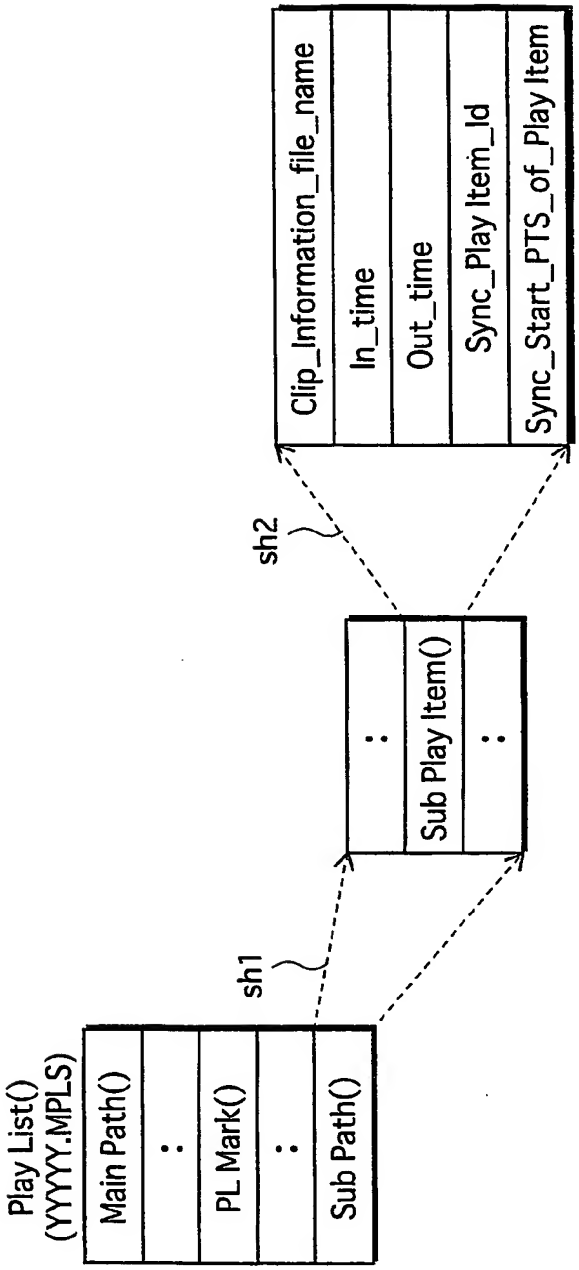

Play List()
(YYYY.MPLS)
Main Path()
:
PL Mark()
:
Sub Path()
sh1
:
Sub Play Item()
:
sh2
Clip_Information_file_name
In_time
Out_time
Sync_Play Item_Id
Sync_Start_PTS_of_Play Item

FIG.10

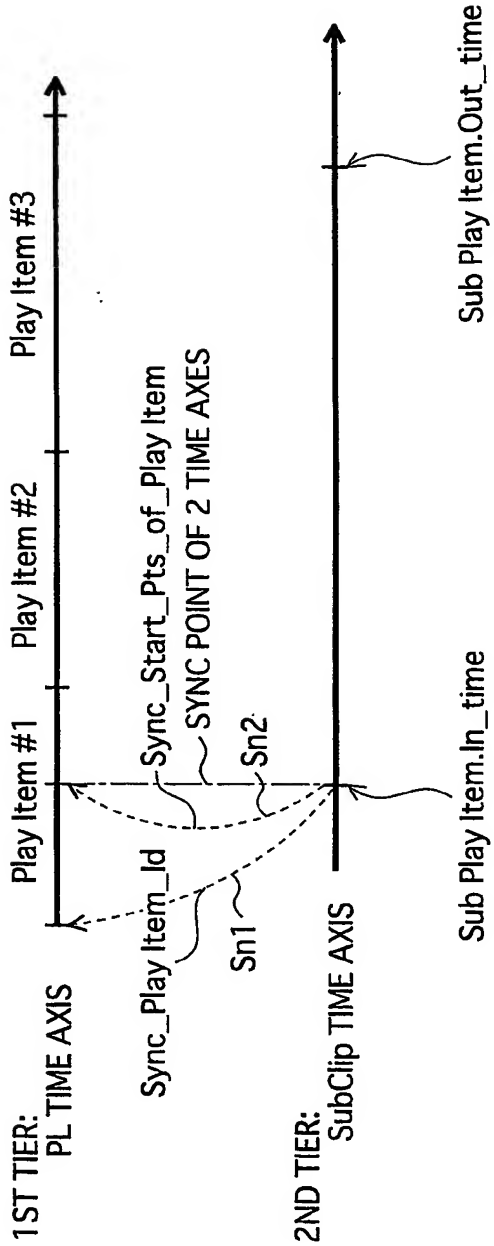

1ST TIER:
PL TIME AXIS
Play Item #1
Play Item #2
Play Item #3
Sync_Start_Pts_of_Play Item
SYNC POINT OF 2 TIME AXES
Sn2
Sn1
Sync_Play Item_Id
2ND TIER:
SubClip TIME AXIS
Sub Play Item.In_time
Sub Play Item.Out_time

FIG.11A

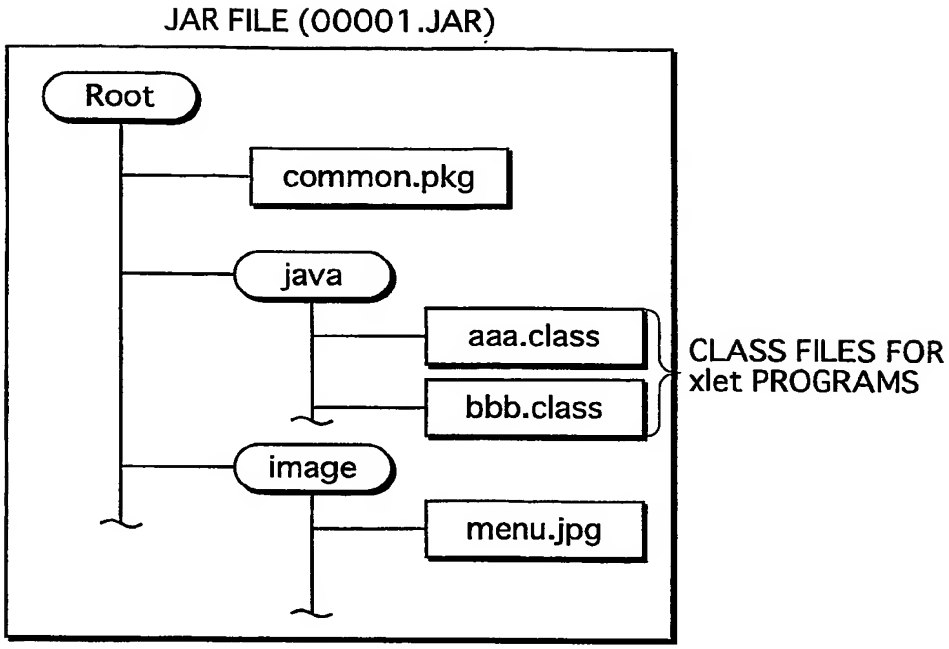



FIG.11B

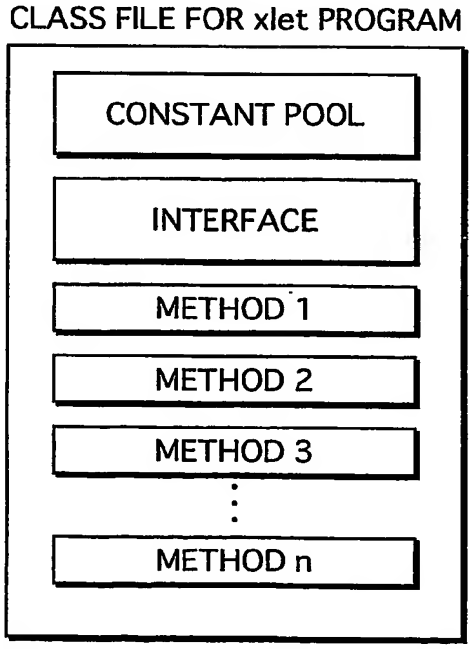


FIG.12

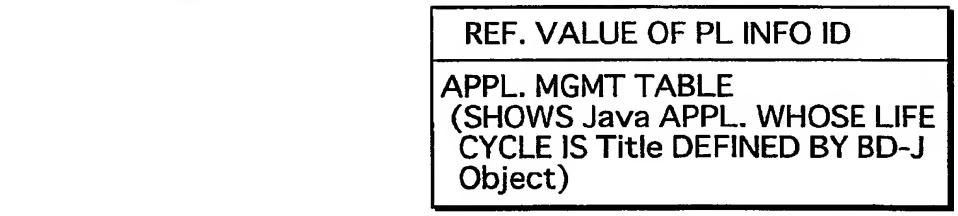

INFO ASSOCIATING
Java APPL. WITH STREAM ··· BD-JObject XXXXX.BOBJ
REF. VALUE OF PL INFO ID
APPL. MGMT TABLE
(SHOWS Java APPL. WHOSE LIFE CYCLE IS Title DEFINED BY BD-J Object)

FIG.13

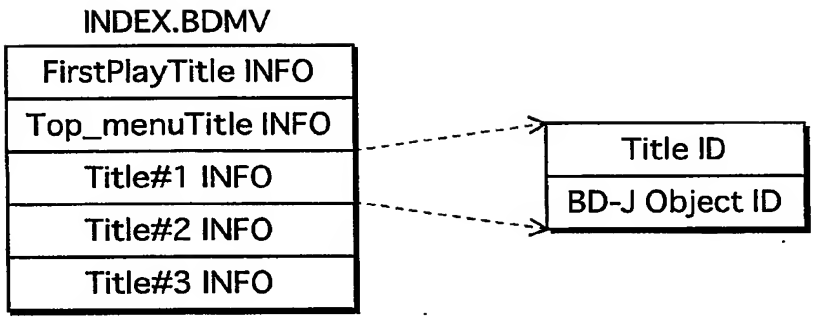

INDEX.BDMV
FirstPlayTitle INFO
Top_menuTitle INFO
Title#1 INFO
Title#2 INFO
Title#3 INFO
Title ID
BD-J Object ID

FIG.14

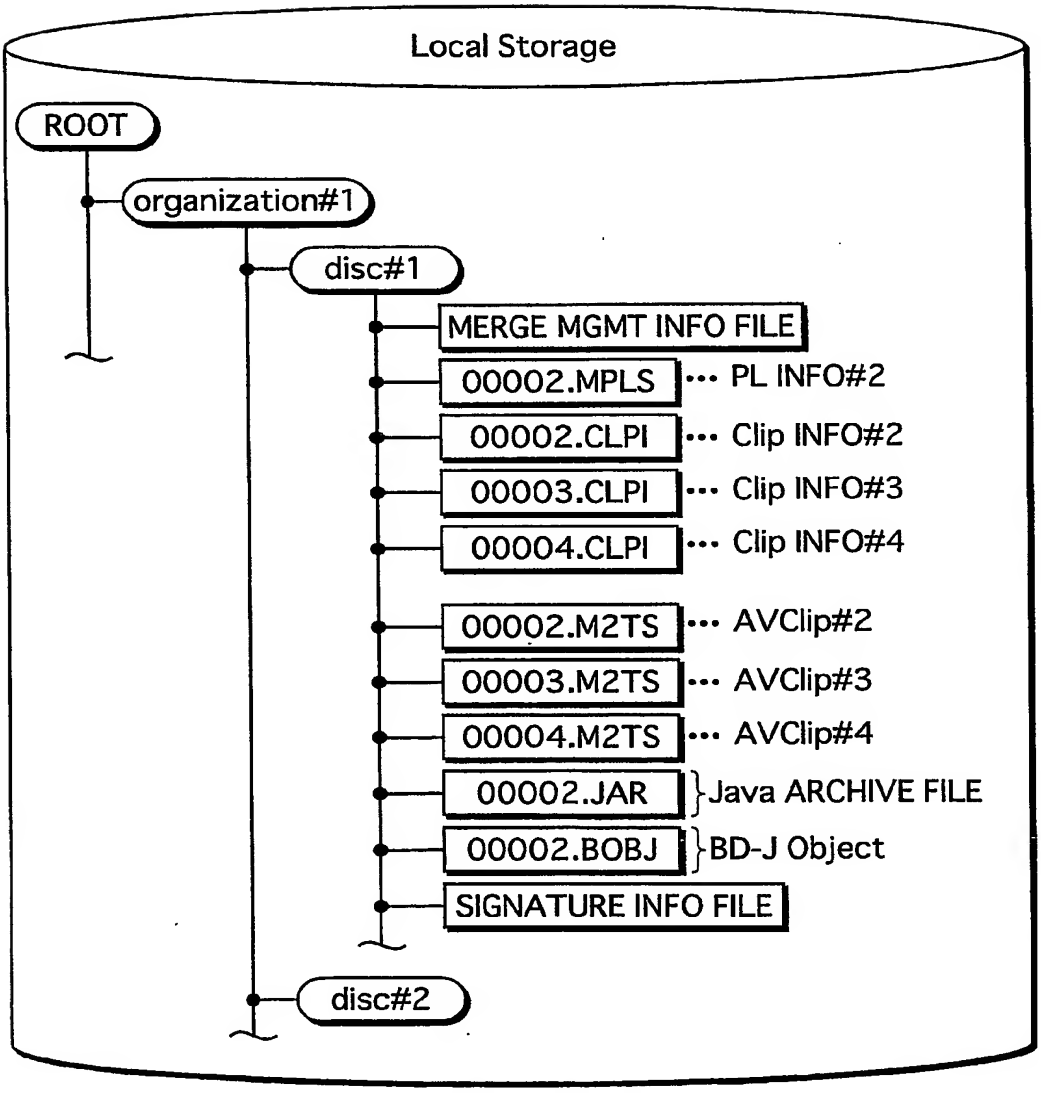

Local Storage
ROOT
organization#1
disc#1
MERGE MGMT INFO FILE
00002.MPLS
PL INFO#2
00002.CLPI
Clip INFO#2
00003.CLPI
Clip INFO#3
00004.CLPI
Clip INFO#4
00002.M2TS
AVClip#2
00003.M2TS
AVClip#3
00004.M2TS
AVClip#4
00002.JAR
Java ARCHIVE FILE
00002.BOBJ
BD-J Object
SIGNATURE INFO FILE
disc#2

FIG.15

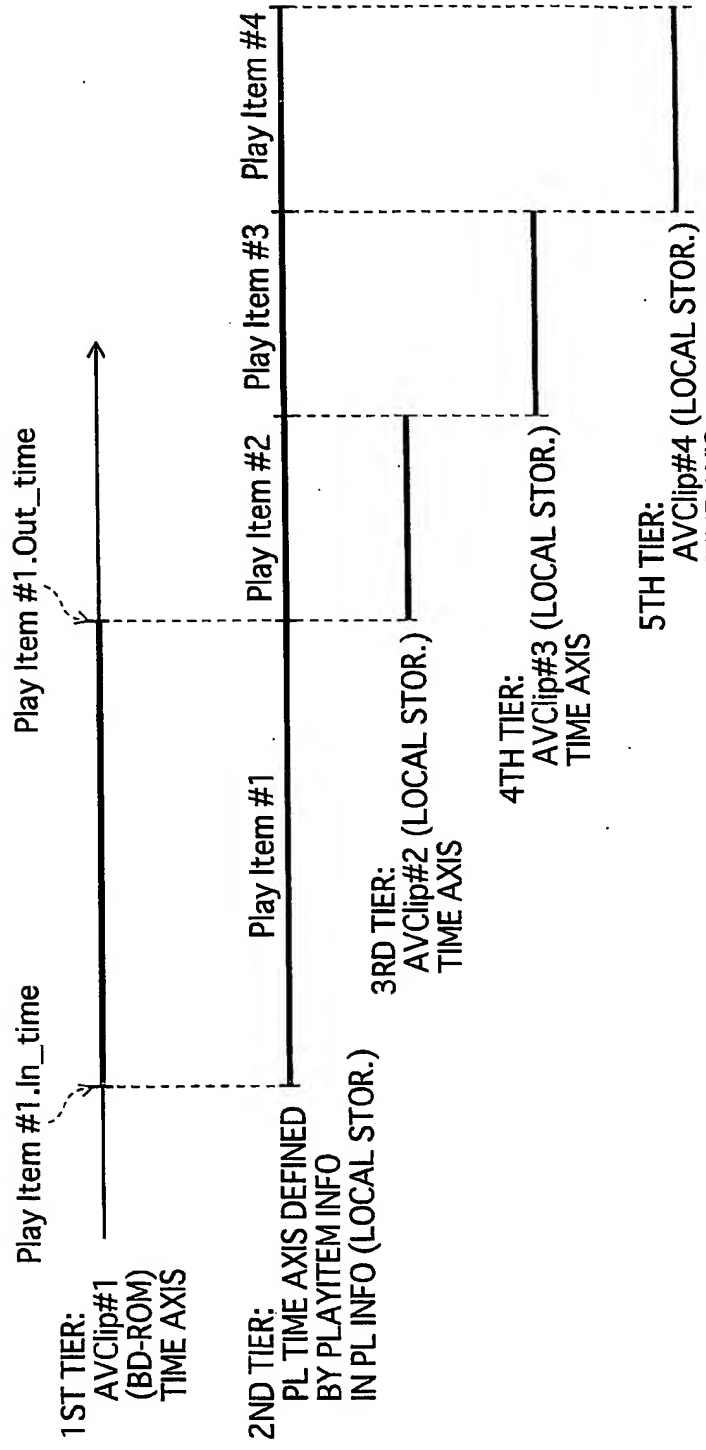

Play Item #1.In_time
Play Item #1.Out_time
1ST TIER:
AVClip#1
(BD-ROM)
TIME AXIS
2ND TIER:
PL TIME AXIS DEFINED
BY PLAYITEM INFO
IN PL INFO (LOCAL STOR.)
Play Item #1
Play Item #2
Play Item #3
Play Item #4
3RD TIER:
AVClip#2 (LOCAL STOR.)
TIME AXIS
4TH TIER:
AVClip#3 (LOCAL STOR.)
TIME AXIS
5TH TIER:
AVClip#4 (LOCAL STOR.)
TIME AXIS

FIG.16A

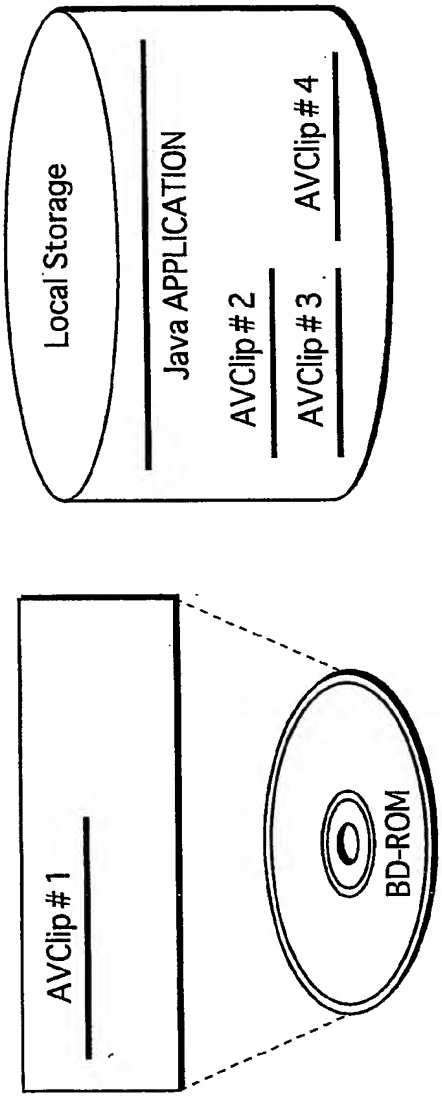



FIG.16B

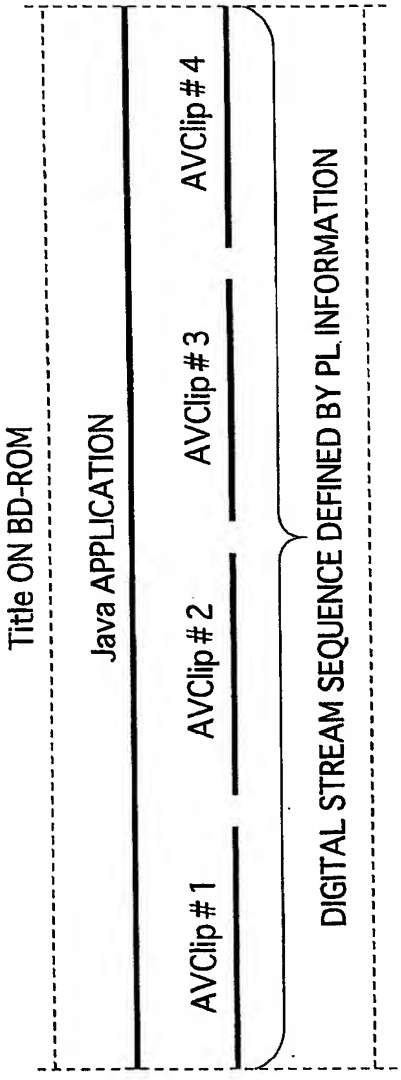


FIG.17

MERGE MANAGEMENT INFORMATION FILE

| STORAGE LOCATIONS IN LOCAL STORAGE | IDS IN Virtual Package |
|---|---|
| /organization #1/disc #1/00002.mpls | BDMV/PLAYLIST/00002.mpls |
| /organization #1/disc #1/00002.clpi | BDMV/CLIPINF/00002.clpi |
| /organization #1/disc #1/00003.clpi | BDMV/CLIPINF/00003.clpi |
| : : | : : |

FIG.18

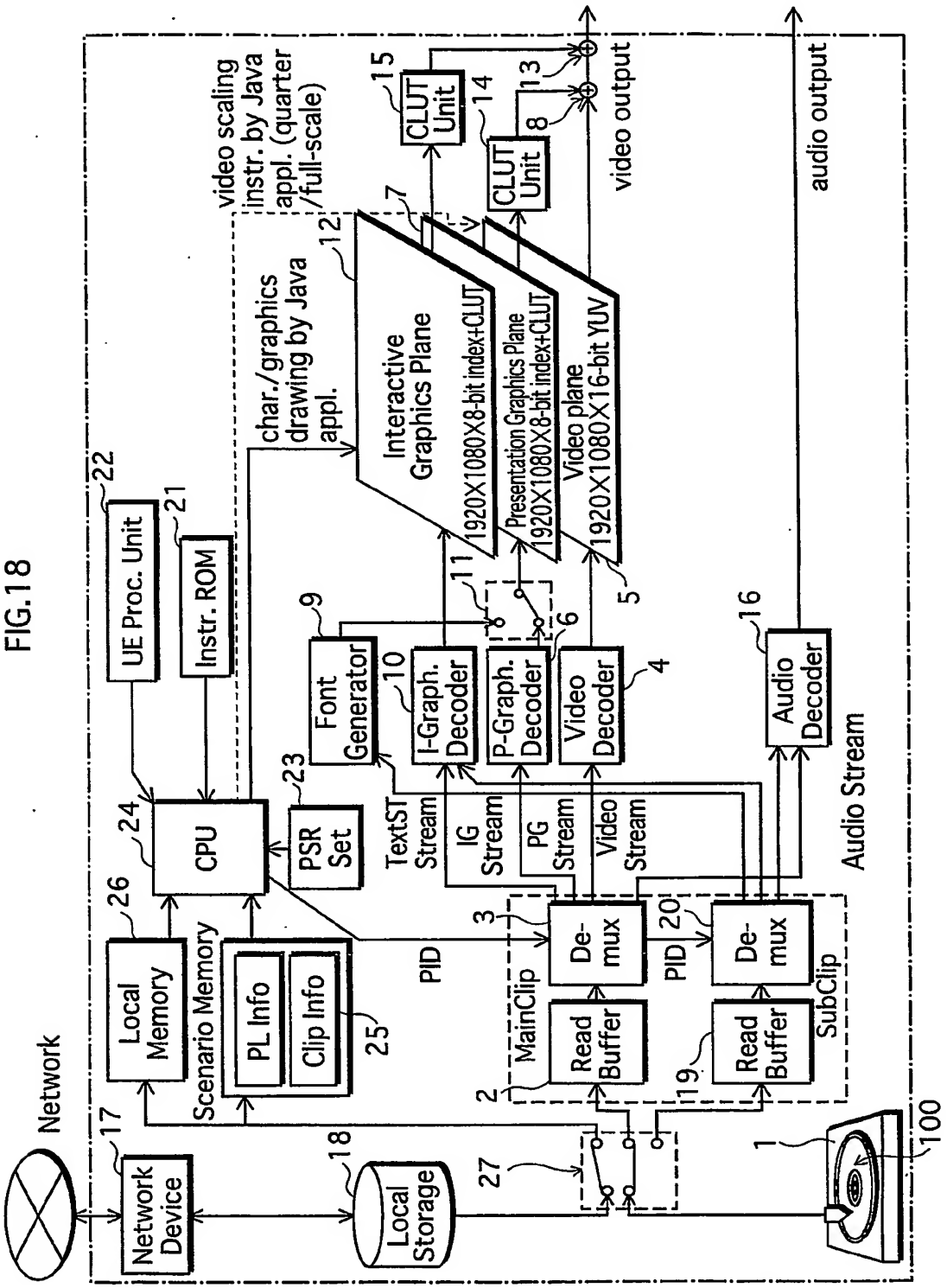
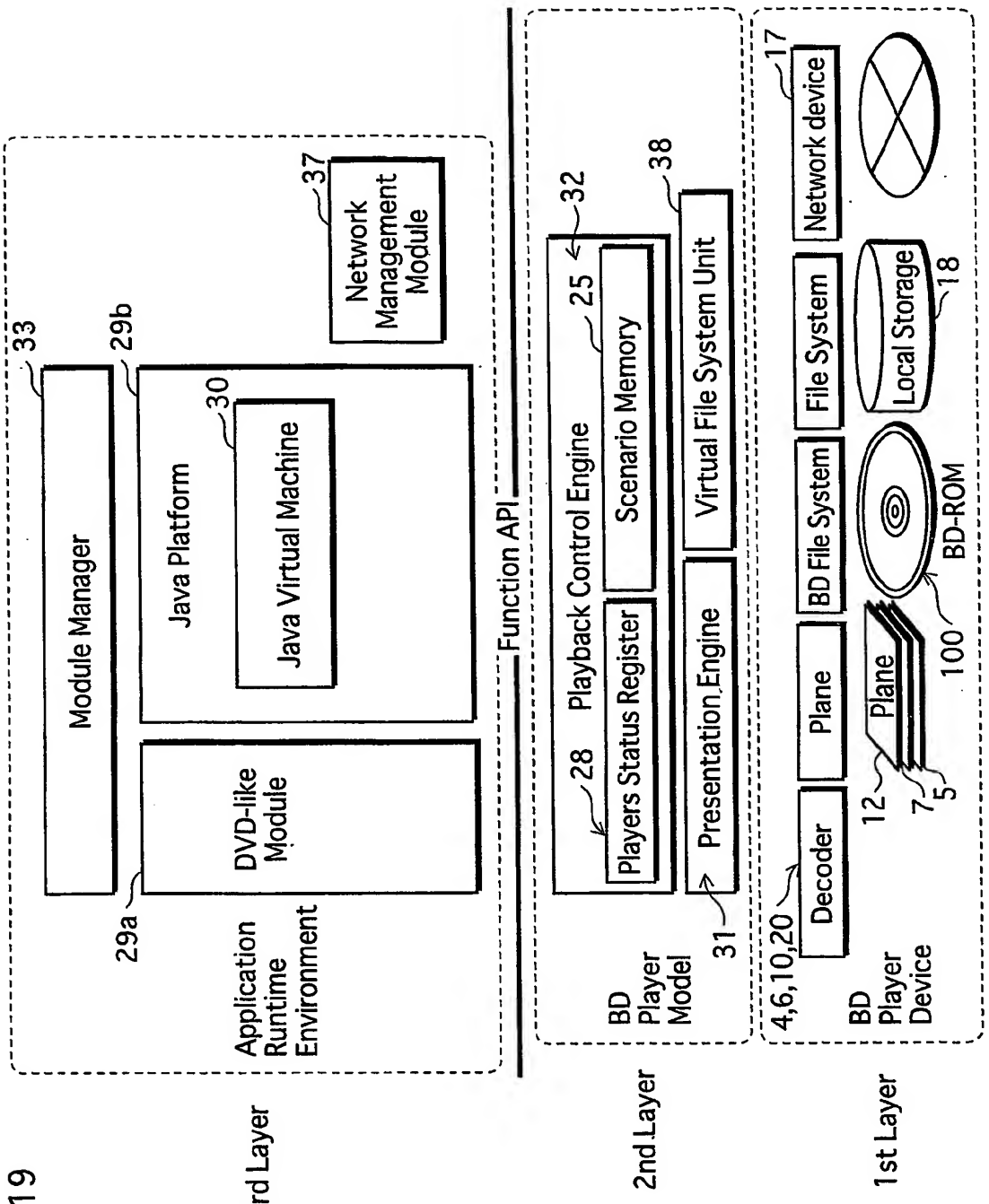

Network
Network Device
17
Local Storage
18
27
1
100
Local Memory
26
Scenario Memory
PL Info
Clip Info
25
PID
CPU
24
PSR Set
23
UE Proc. Unit
22
Instr. ROM
21
video scaling instr. by Java appl. (quarter /full-scale)
char./graphics drawing by Java appl.
Font Generator
9
TextST Stream
I-Graph. Decoder
10
IG Stream
P-Graph. Decoder
6
PG Stream
Video Decoder
4
Video Stream
Audio Decoder
16
Audio Stream
Interactive Graphics Plane
12
1920X1080X8-bit index+CLUT
11
Presentation Graphics Plane
1920X1080X8-bit index+CLUT
Video plane
1920X1080X16-bit YUV
5
CLUT Unit
15
CLUT Unit
14
8
13
video output
audio output
3
De-mux
20
PID
MainClip
Read Buffer
2
SubClip
Read Buffer
19

FIG.19


3rd Layer
2nd Layer
1st Layer
Application Runtime Environment
BD Player Model
BD Player Device
29a
DVD-like Module
29b
Java Platform
30
Java Virtual Machine
33
Module Manager
37
Network Management Module
Function API
28
Players Status Register
Playback Control Engine
25
Scenario Memory
32
38
Virtual File System Unit
31
Presentation Engine
4,6,10,20
Decoder
Plane
12
Plane
7
5
BD File System
100
BD-ROM
File System
Local Storage
18
17
Network device

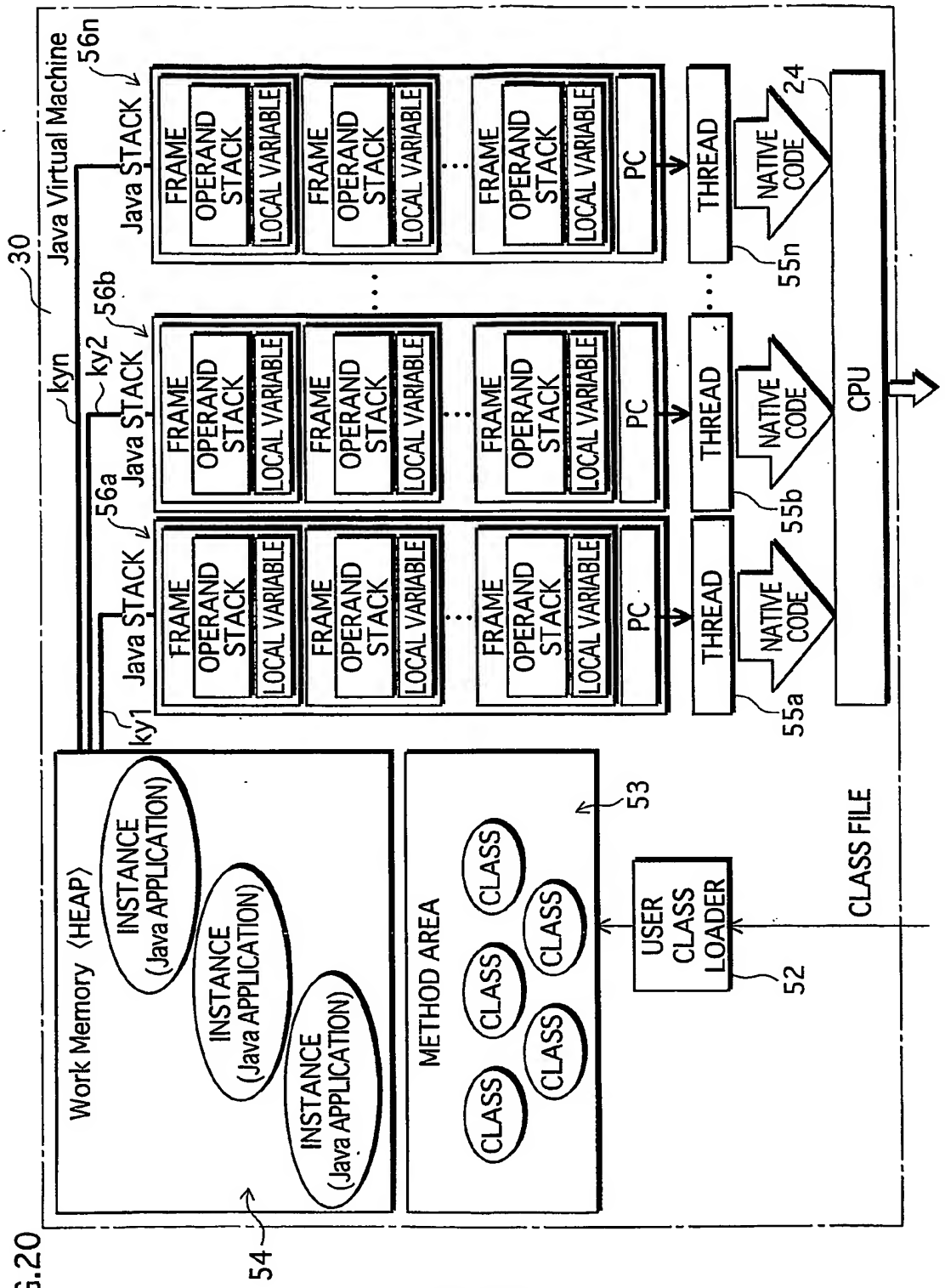
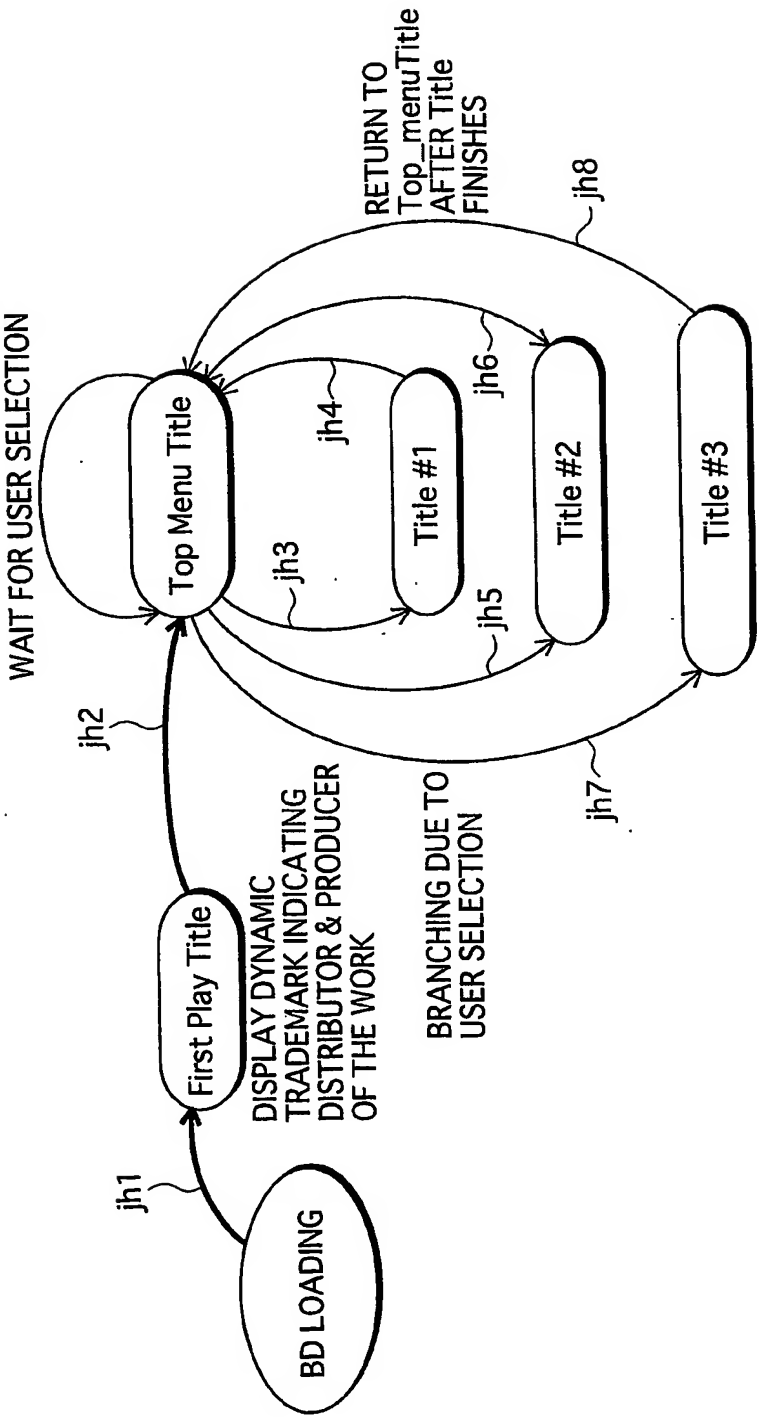

30
Java Virtual Machine
56n
56b
56a
Java STACK
ky1
ky2
kyn
FRAME
OPERAND STACK
LOCAL VARIABLE
PC
THREAD
NATIVE CODE
55a
55b
55n
24
CPU
Work Memory (HEAP)
INSTANCE (Java APPLICATION)
54
METHOD AREA
CLASS
53
USER CLASS LOADER
52
CLASS FILE

FIG.20

FIG.21


BD LOADING
jh1
First Play Title
DISPLAY DYNAMIC TRADEMARK INDICATING DISTRIBUTOR & PRODUCER OF THE WORK
jh2
WAIT FOR USER SELECTION
Top Menu Title
jh3
jh4
Title #1
jh5
Title #2
jh6
Title #3
jh7
BRANCHING DUE TO USER SELECTION
jh8
RETURN TO Top_menuTitle AFTER Title FINISHES

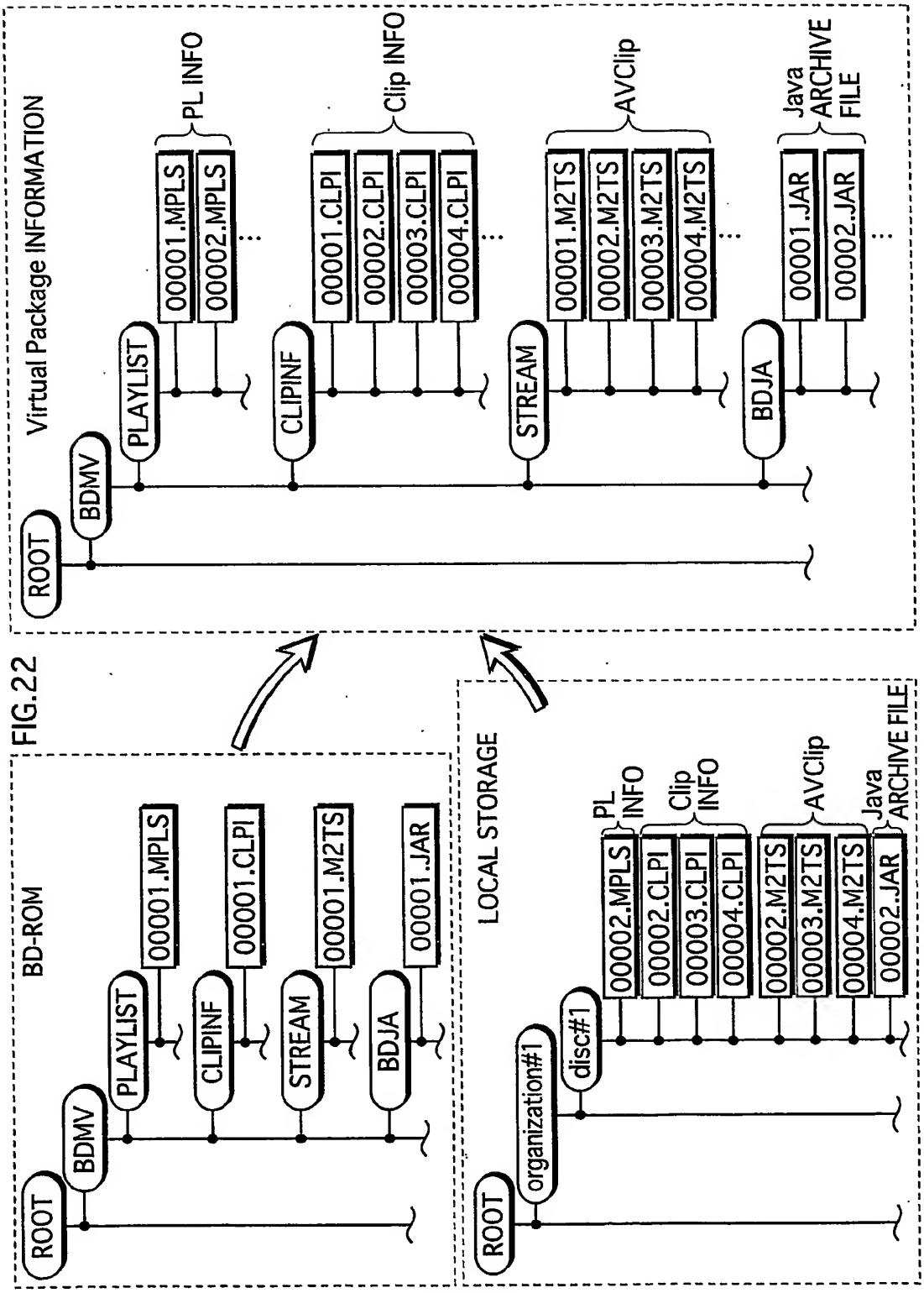

Virtual Package INFORMATION
ROOT
BDMV
PLAYLIST
CLIPINF
STREAM
BDJA
00001.MPLS
00002.MPLS
00001.CLPI
00002.CLPI
00003.CLPI
00004.CLPI
00001.M2TS
00002.M2TS
00003.M2TS
00004.M2TS
00001.JAR
00002.JAR
PL INFO
Clip INFO
AVClip
Java ARCHIVE FILE
BD-ROM
LOCAL STORAGE
organization#1
disc#1
PL INFO
Clip INFO
AVClip
Java ARCHIVE FILE

FIG.22

FIG.23A

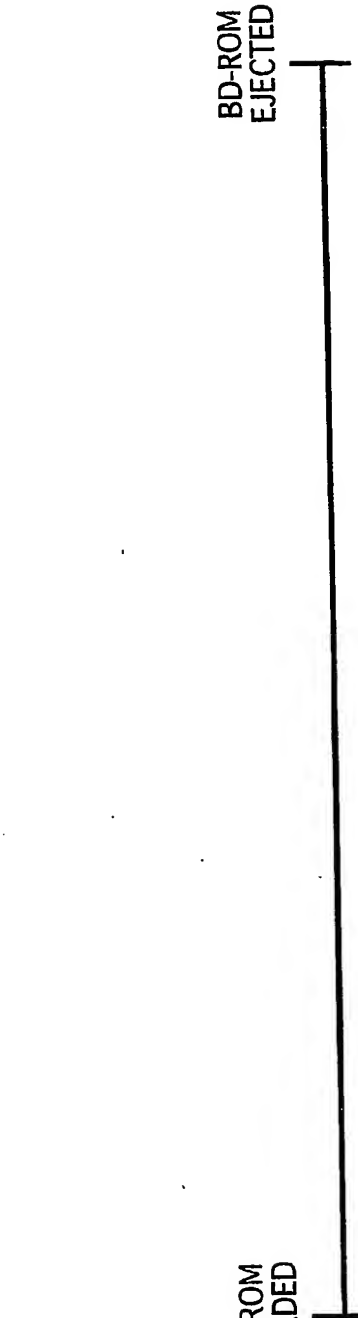



FIG.23B

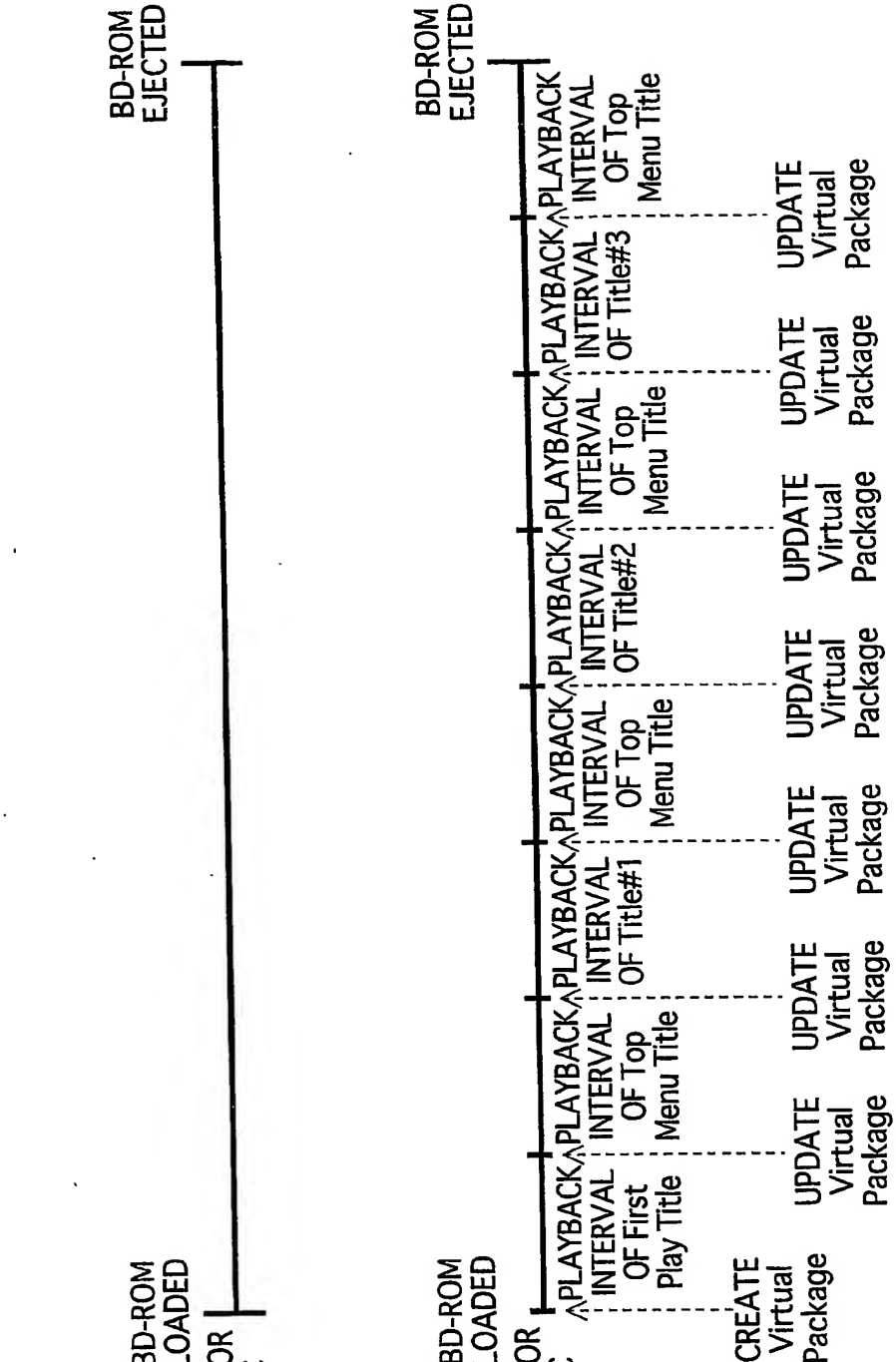


FIG.24

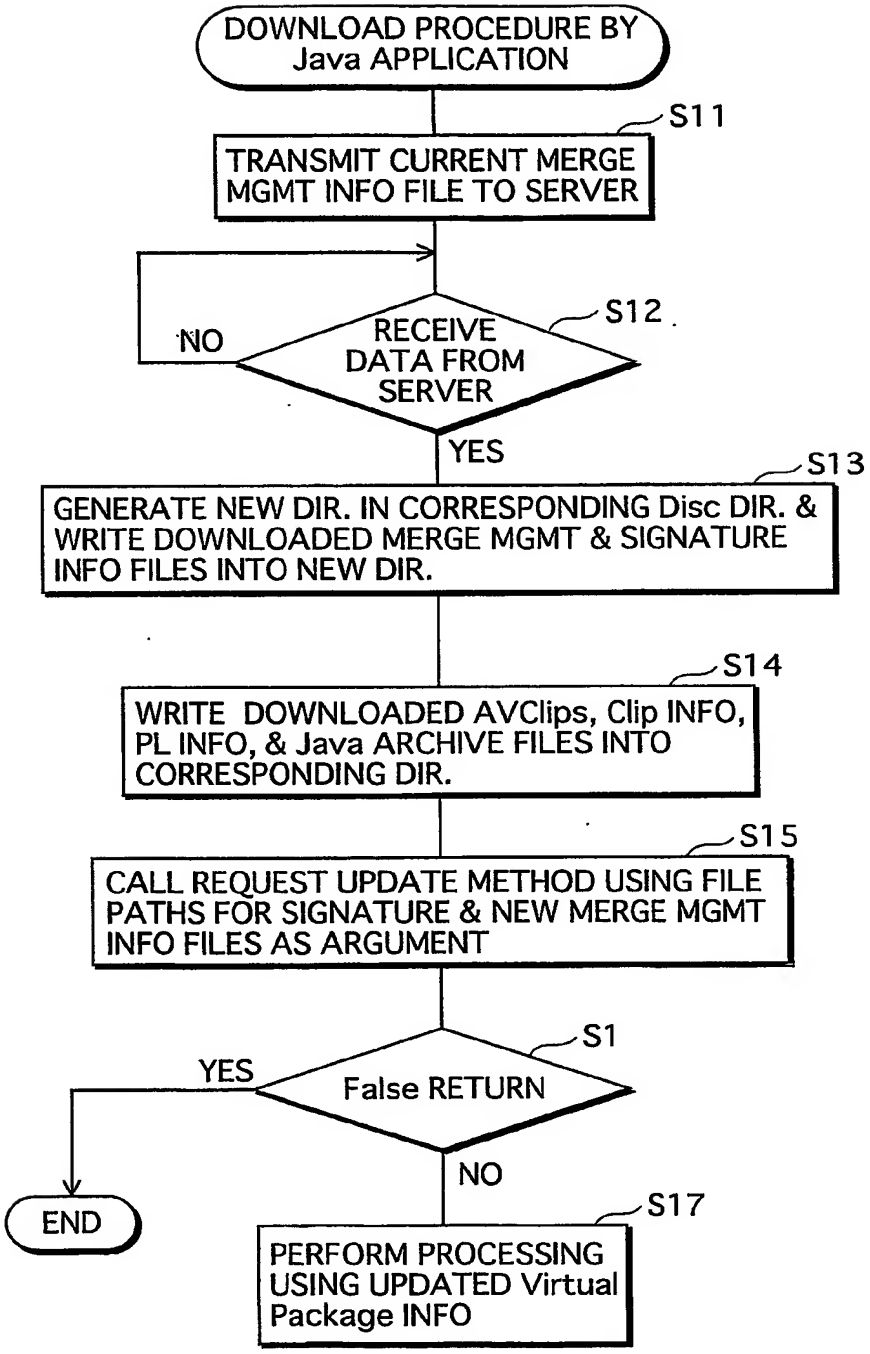

DOWNLOAD PROCEDURE BY Java APPLICATION
S11
TRANSMIT CURRENT MERGE MGMT INFO FILE TO SERVER
S12
RECEIVE DATA FROM SERVER
NO
YES
S13
GENERATE NEW DIR. IN CORRESPONDING Disc DIR. & WRITE DOWNLOADED MERGE MGMT & SIGNATURE INFO FILES INTO NEW DIR.
S14
WRITE DOWNLOADED AVClips, Clip INFO, PL INFO, & Java ARCHIVE FILES INTO CORRESPONDING DIR.
S15
CALL REQUEST UPDATE METHOD USING FILE PATHS FOR SIGNATURE & NEW MERGE MGMT INFO FILES AS ARGUMENT
S1
False RETURN
YES
NO
END
S17
PERFORM PROCESSING USING UPDATED Virtual Package INFO

FIG.25

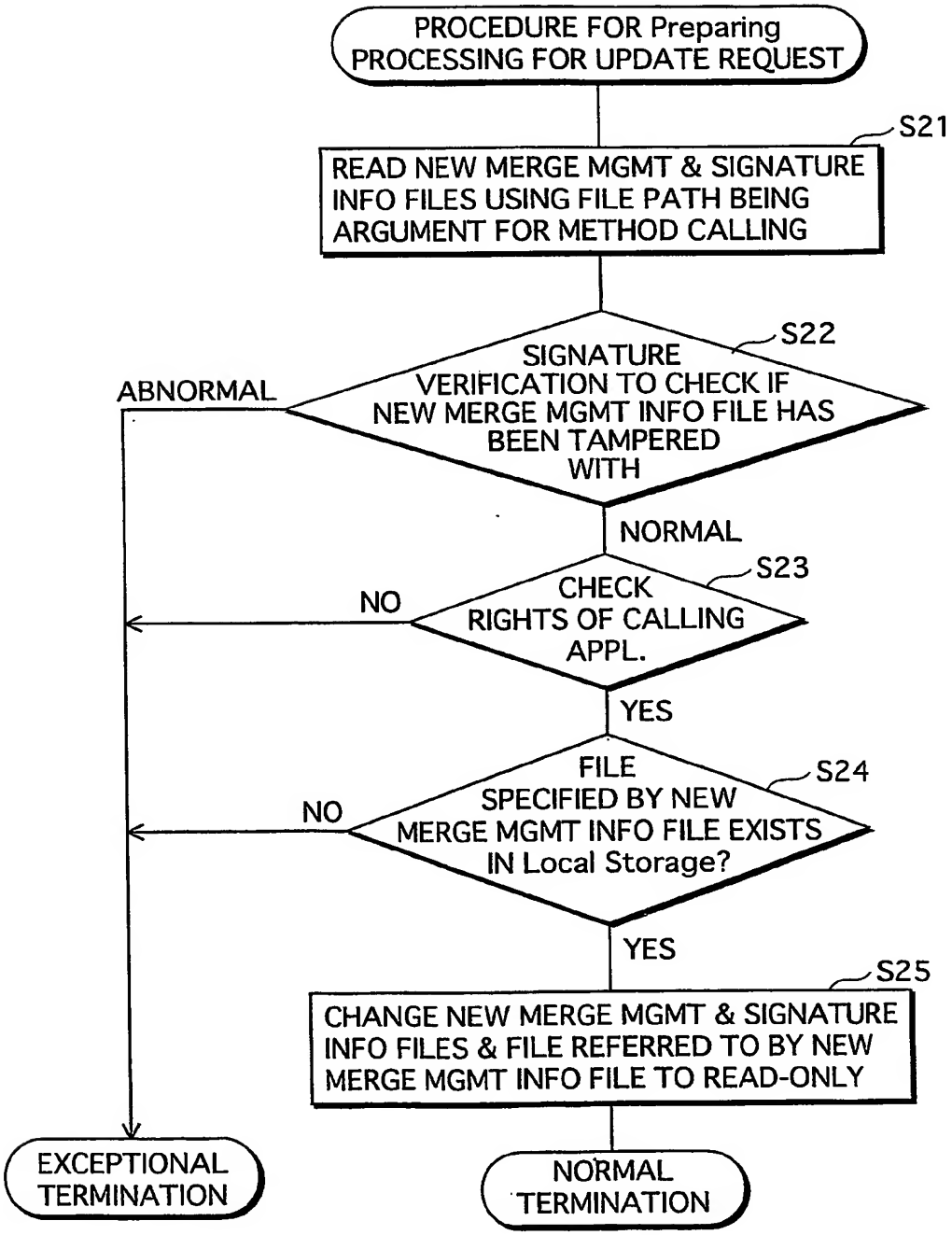

PROCEDURE FOR Preparing PROCESSING FOR UPDATE REQUEST
S21
READ NEW MERGE MGMT & SIGNATURE INFO FILES USING FILE PATH BEING ARGUMENT FOR METHOD CALLING
S22
SIGNATURE VERIFICATION TO CHECK IF NEW MERGE MGMT INFO FILE HAS BEEN TAMPERED WITH
ABNORMAL
NORMAL
S23
CHECK RIGHTS OF CALLING APPL.
NO
YES
S24
FILE SPECIFIED BY NEW MERGE MGMT INFO FILE EXISTS IN Local Storage?
NO
YES
S25
CHANGE NEW MERGE MGMT & SIGNATURE INFO FILES & FILE REFERRED TO BY NEW MERGE MGMT INFO FILE TO READ-ONLY
EXCEPTIONAL TERMINATION
NORMAL TERMINATION

FIG.26

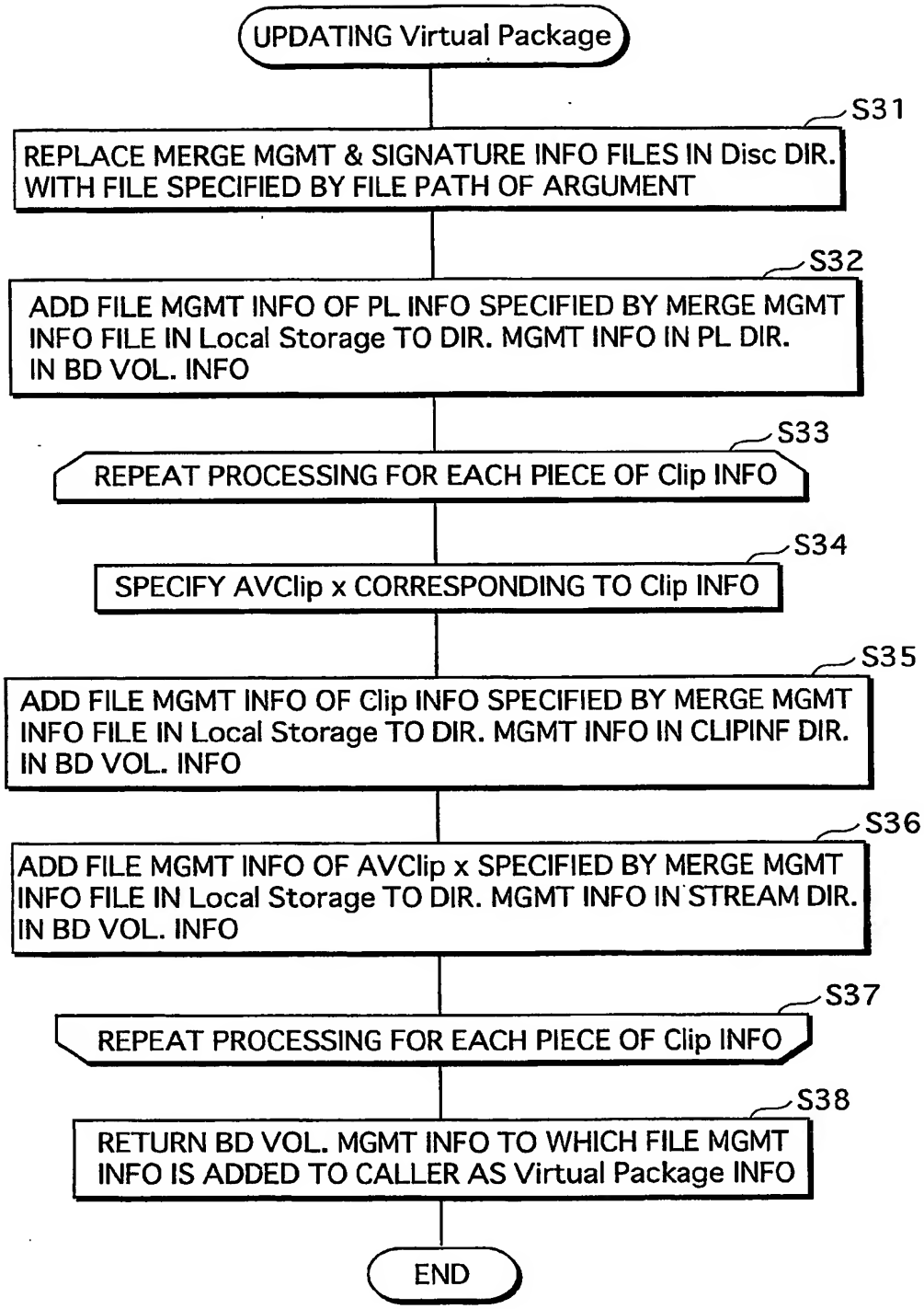

UPDATING Virtual Package
S31
REPLACE MERGE MGMT & SIGNATURE INFO FILES IN Disc DIR. WITH FILE SPECIFIED BY FILE PATH OF ARGUMENT
S32
ADD FILE MGMT INFO OF PL INFO SPECIFIED BY MERGE MGMT INFO FILE IN Local Storage TO DIR. MGMT INFO IN PL DIR. IN BD VOL. INFO
S33
REPEAT PROCESSING FOR EACH PIECE OF Clip INFO
S34
SPECIFY AVClip x CORRESPONDING TO Clip INFO
S35
ADD FILE MGMT INFO OF Clip INFO SPECIFIED BY MERGE MGMT INFO FILE IN Local Storage TO DIR. MGMT INFO IN CLIPINF DIR. IN BD VOL. INFO
S36
ADD FILE MGMT INFO OF AVClip x SPECIFIED BY MERGE MGMT INFO FILE IN Local Storage TO DIR. MGMT INFO IN STREAM DIR. IN BD VOL. INFO
S37
REPEAT PROCESSING FOR EACH PIECE OF Clip INFO
S38
RETURN BD VOL. MGMT INFO TO WHICH FILE MGMT INFO IS ADDED TO CALLER AS Virtual Package INFO
END

FIG.27

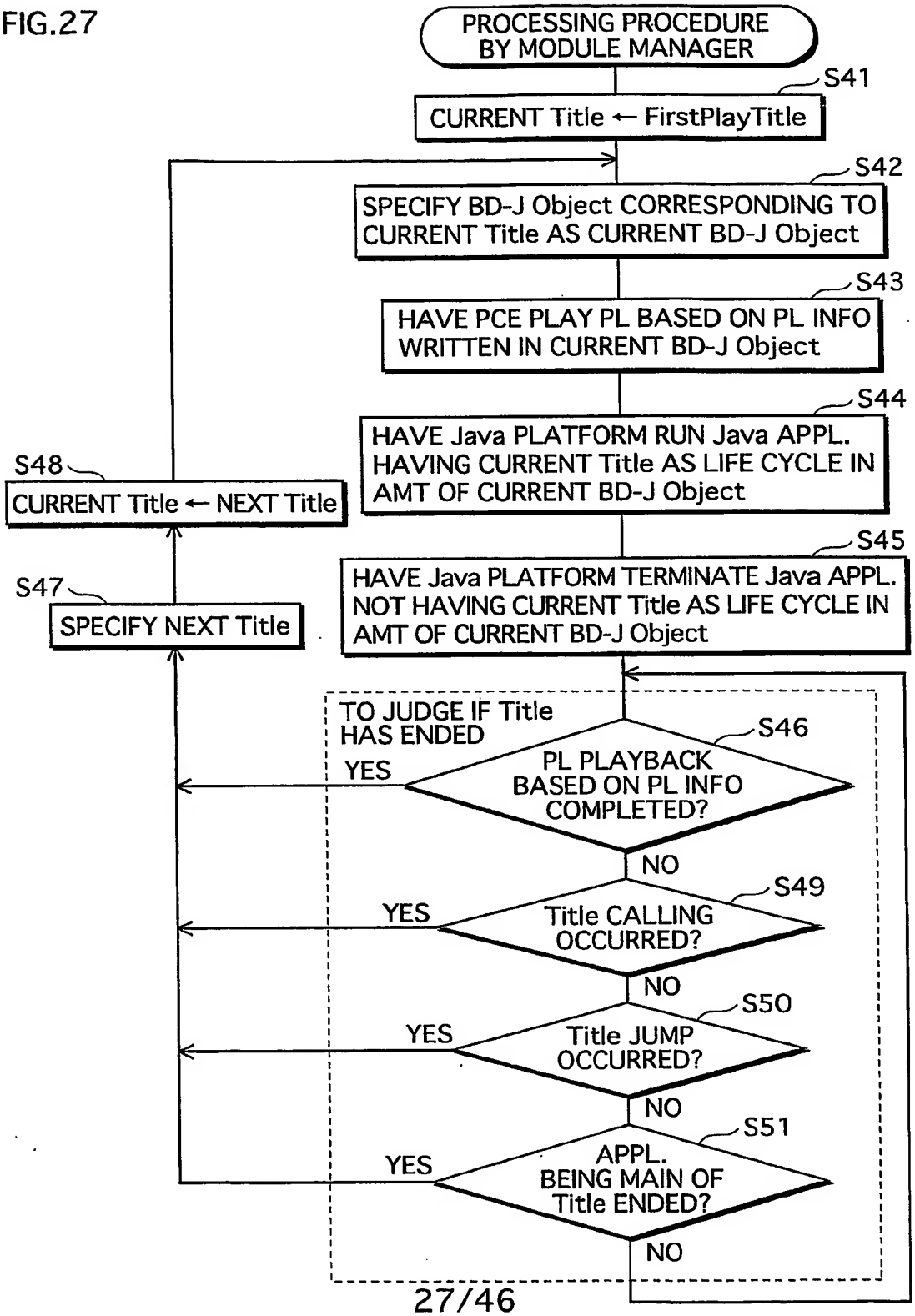

PROCESSING PROCEDURE BY MODULE MANAGER
S41
CURRENT Title ← FirstPlayTitle
S42
SPECIFY BD-J Object CORRESPONDING TO CURRENT Title AS CURRENT BD-J Object
S43
HAVE PCE PLAY PL BASED ON PL INFO WRITTEN IN CURRENT BD-J Object
S44
HAVE Java PLATFORM RUN Java APPL. HAVING CURRENT Title AS LIFE CYCLE IN AMT OF CURRENT BD-J Object
S45
HAVE Java PLATFORM TERMINATE Java APPL. NOT HAVING CURRENT Title AS LIFE CYCLE IN AMT OF CURRENT BD-J Object
TO JUDGE IF Title HAS ENDED
S46
PL PLAYBACK BASED ON PL INFO COMPLETED?
YES
NO
S49
Title CALLING OCCURRED?
YES
NO
S50
Title JUMP OCCURRED?
YES
NO
S51
APPL. BEING MAIN OF Title ENDED?
YES
NO
S47
SPECIFY NEXT Title
S48
CURRENT Title ← NEXT Title

FIG.28

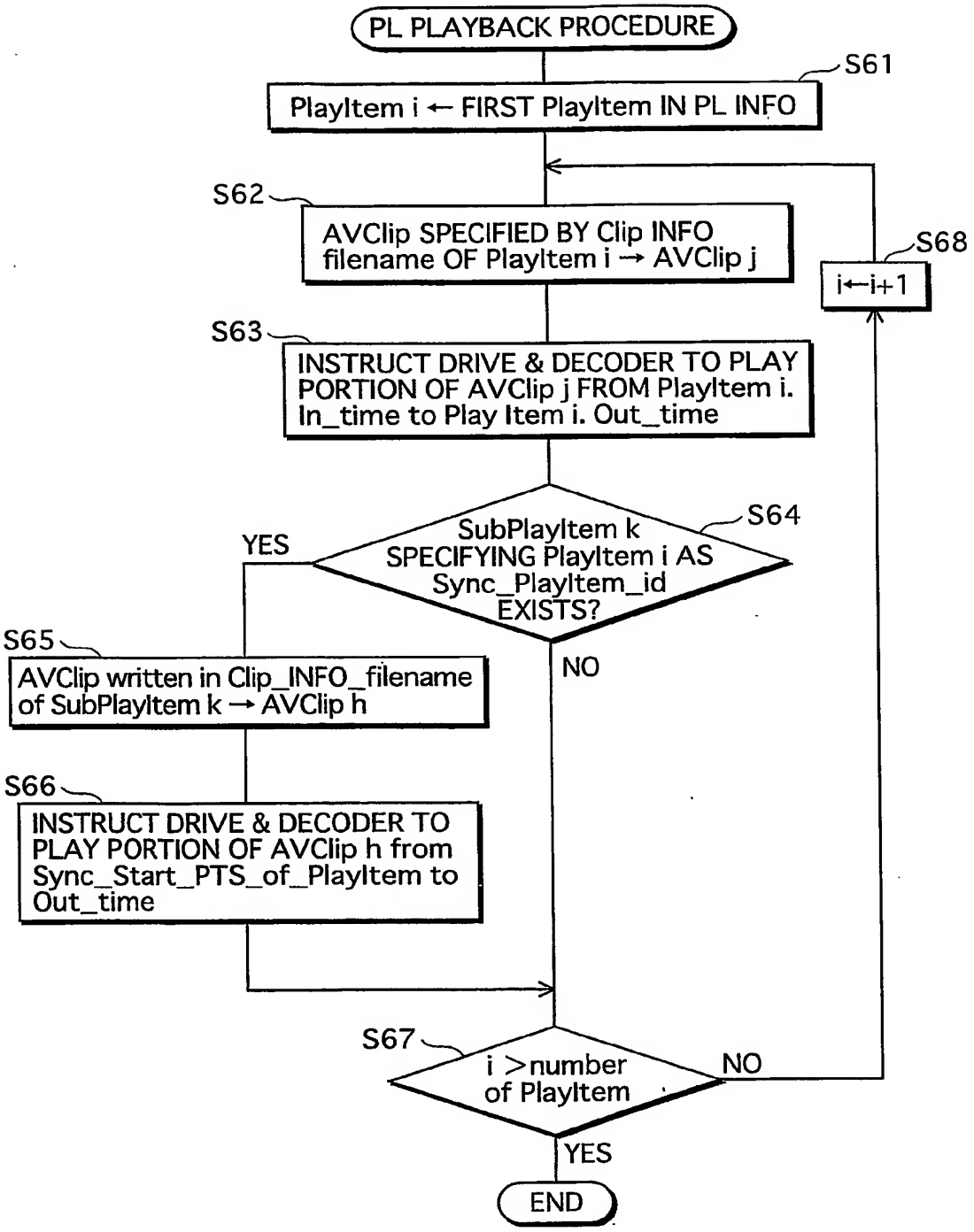

PL PLAYBACK PROCEDURE
S61
PlayItem i ← FIRST PlayItem IN PL INFO
S62
AVClip SPECIFIED BY Clip INFO filename OF PlayItem i → AVClip j
S68
i←i+1
S63
INSTRUCT DRIVE & DECODER TO PLAY PORTION OF AVClip j FROM PlayItem i. In_time to Play Item i. Out_time
S64
SubPlayItem k SPECIFYING PlayItem i AS Sync_PlayItem_id EXISTS?
YES
NO
S65
AVClip written in Clip_INFO_filename of SubPlayItem k → AVClip h
S66
INSTRUCT DRIVE & DECODER TO PLAY PORTION OF AVClip h from Sync_Start_PTS_of_PlayItem to Out_time
S67
i >number of PlayItem
NO
YES
END

FIG.29

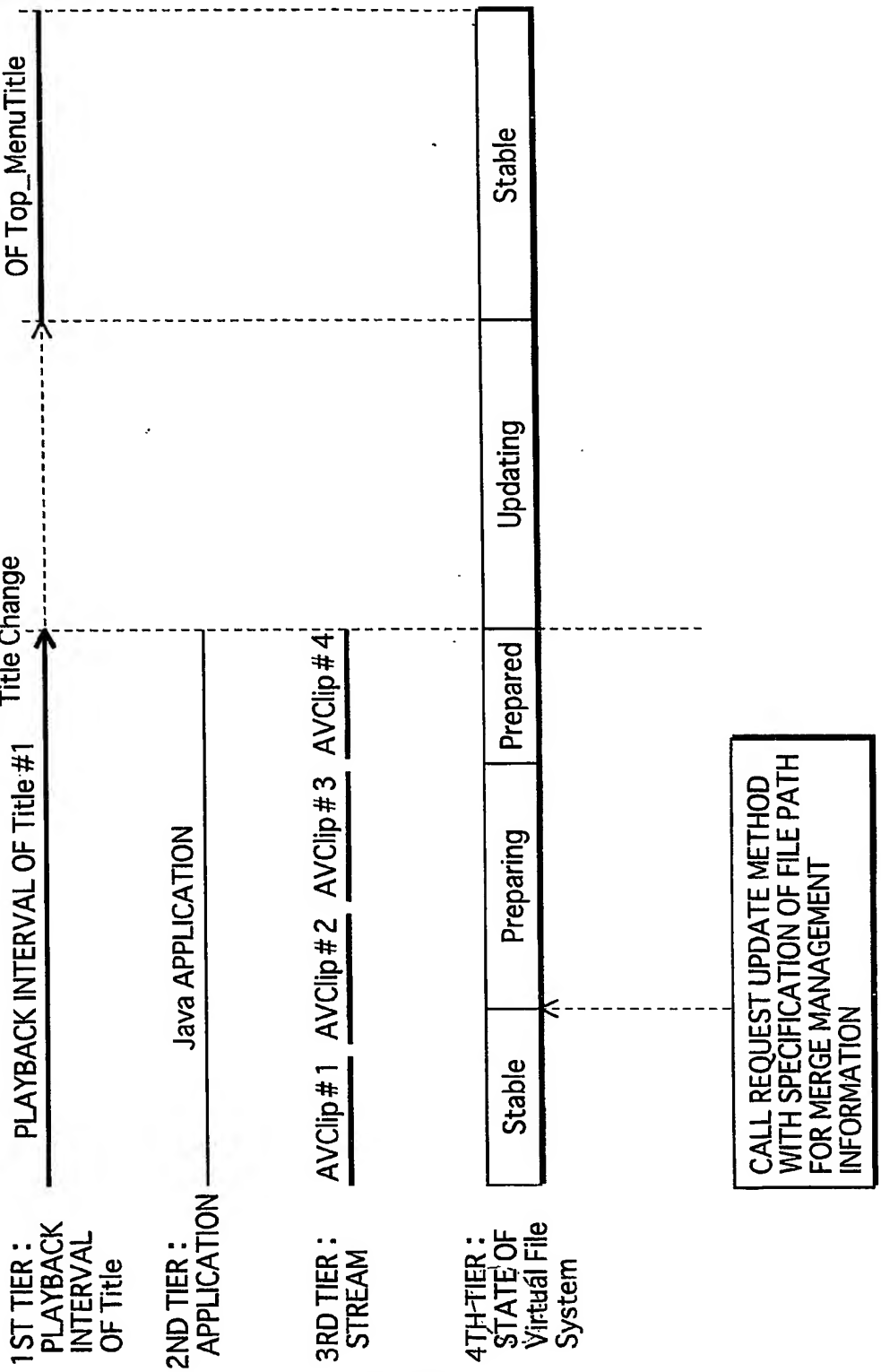

1ST TIER : PLAYBACK INTERVAL OF Title
2ND TIER : APPLICATION
3RD TIER : STREAM
4TH TIER : STATE OF Virtual File System
PLAYBACK INTERVAL OF Title #1
Title Change
PLAYBACK INTERVAL OF Top_MenuTitle
Java APPLICATION
AVClip # 1
AVClip # 2
AVClip # 3
AVClip # 4
Stable
Preparing
Prepared
Updating
Stable
CALL REQUEST UPDATE METHOD WITH SPECIFICATION OF FILE PATH FOR MERGE MANAGEMENT INFORMATION

FIG.30

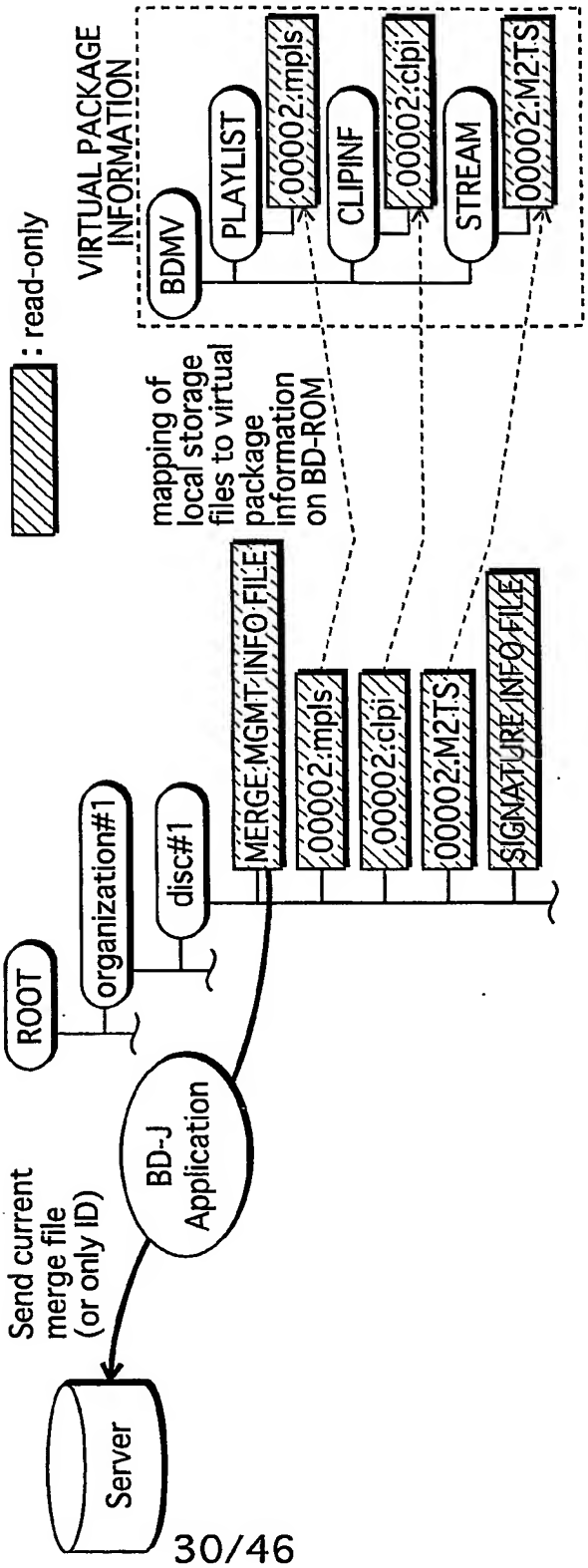

VIRTUAL PACKAGE INFORMATION
BDMV
PLAYLIST
00002:mpls
CLIPINF
00002:clpi
STREAM
00002:M2TS
: read-only
mapping of local storage files to virtual package information on BD-ROM
MERGE.MGMT.INFO FILE
00002:mpls
00002:clpi
00002:M2TS
SIGNATURE.INFO FILE
ROOT
organization#1
disc#1
BD-J Application
Send current merge file (or only ID)
Server

FIG.31

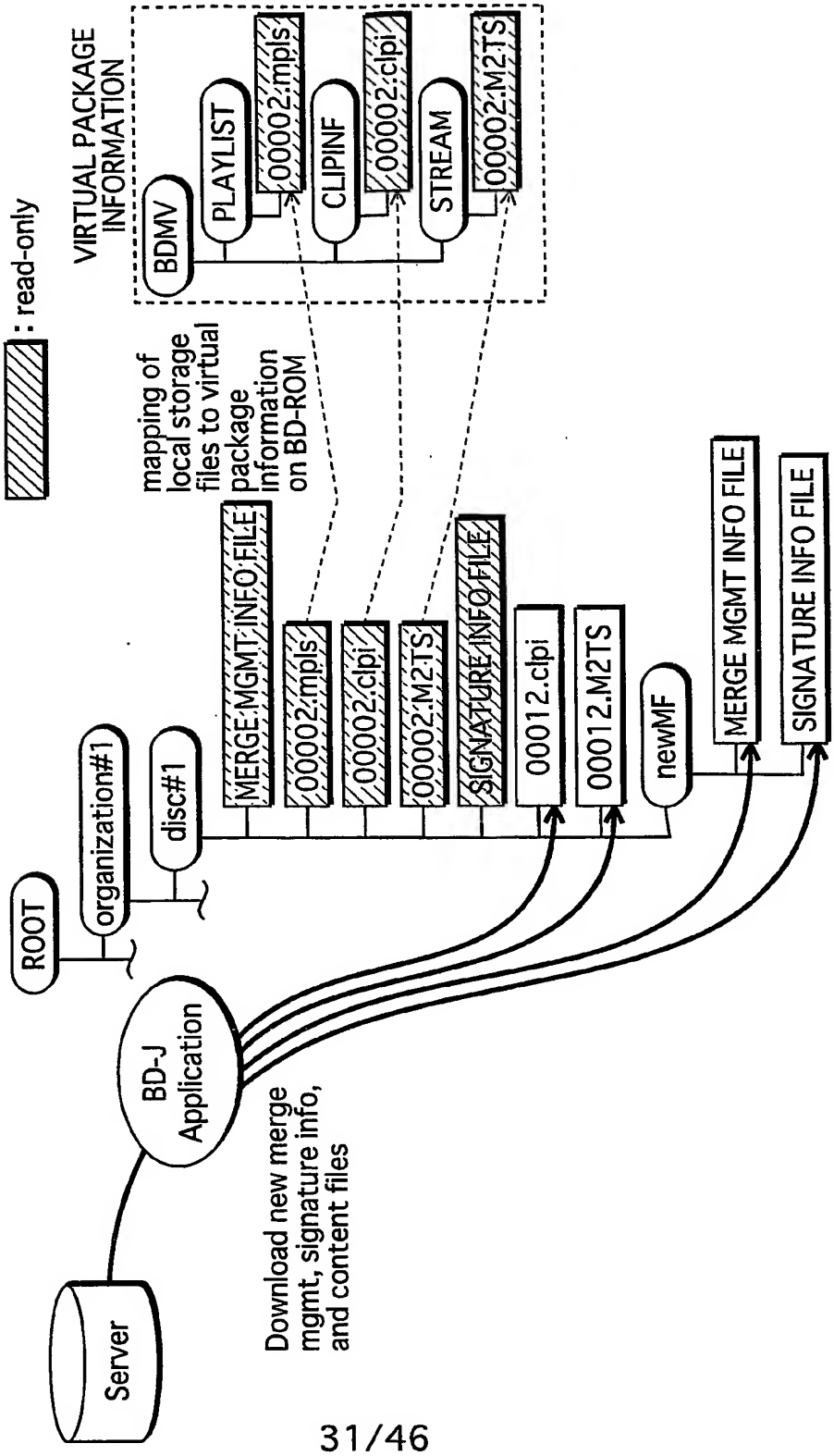

: read-only
VIRTUAL PACKAGE INFORMATION
BDMV
PLAYLIST
00002.mpls
CLIPINF
00002.clpi
STREAM
00002.M2TS
mapping of local storage files to virtual package information on BD-ROM
MERGE.MGMT.INFO.FILE
00002.mpls
00002.clpi
00002.M2TS
SIGNATURE.INFO.FILE
00012.clpi
00012.M2TS
newMF
MERGE MGMT INFO FILE
SIGNATURE INFO FILE
ROOT
organization#1
disc#1
BD-J Application
Server
Download new merge mgmt, signature info, and content files

FIG.32

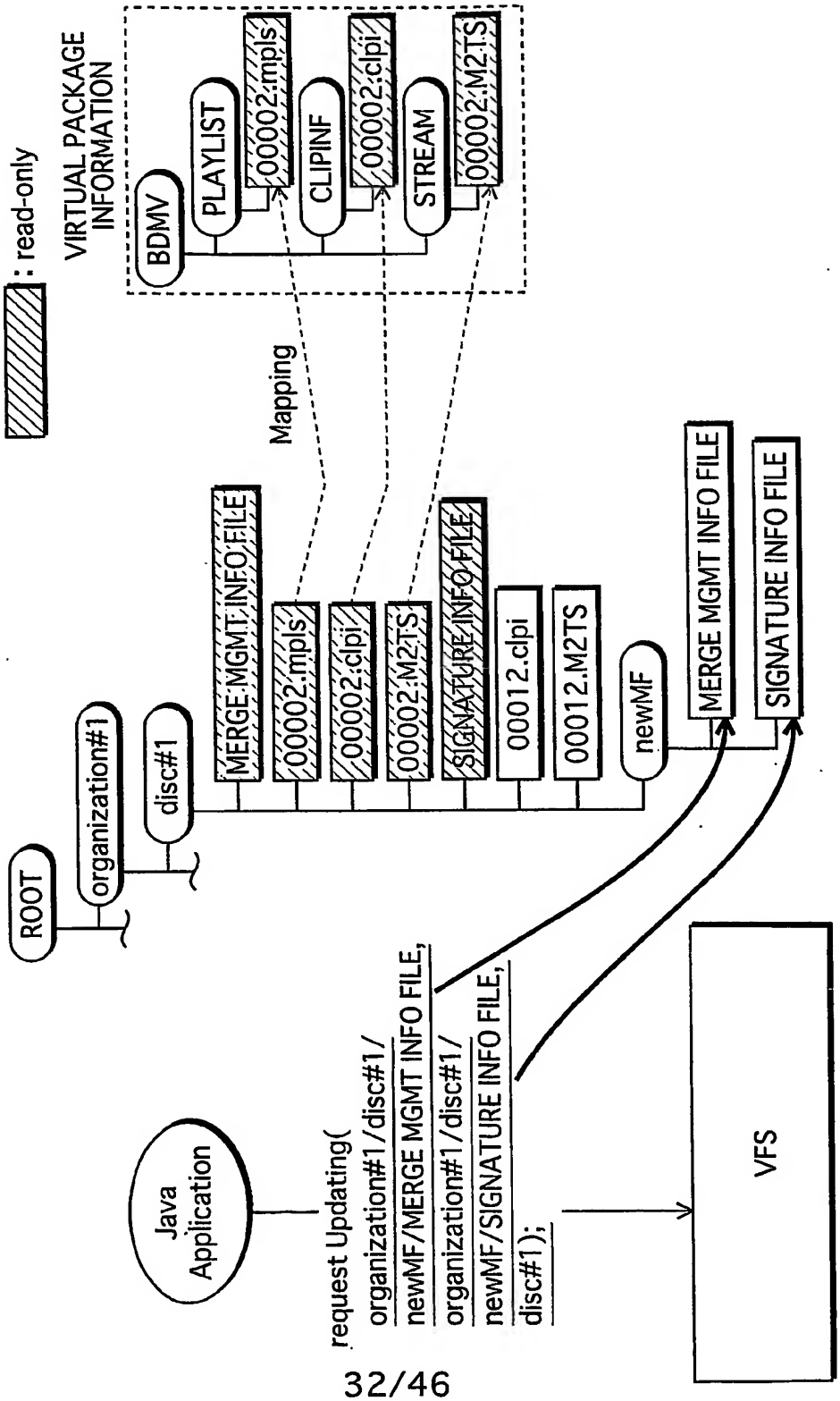

: read-only
VIRTUAL PACKAGE INFORMATION
BDMV
PLAYLIST
00002.mpls
CLIPINF
00002.clpi
STREAM
00002.M2TS
Mapping
ROOT
organization#1
disc#1
MERGE.MGMT.INFO.FILE
00002.mpls
00002.clpi
00002.M2TS
SIGNATURE.INFO.FILE
00012.clpi
00012.M2TS
newMF
MERGE MGMT INFO FILE
SIGNATURE INFO FILE
Java Application
request Updating(
organization#1/disc#1/
newMF/MERGE MGMT INFO FILE,
organization#1/disc#1/
newMF/SIGNATURE INFO FILE,
disc#1);
VFS

FIG.33

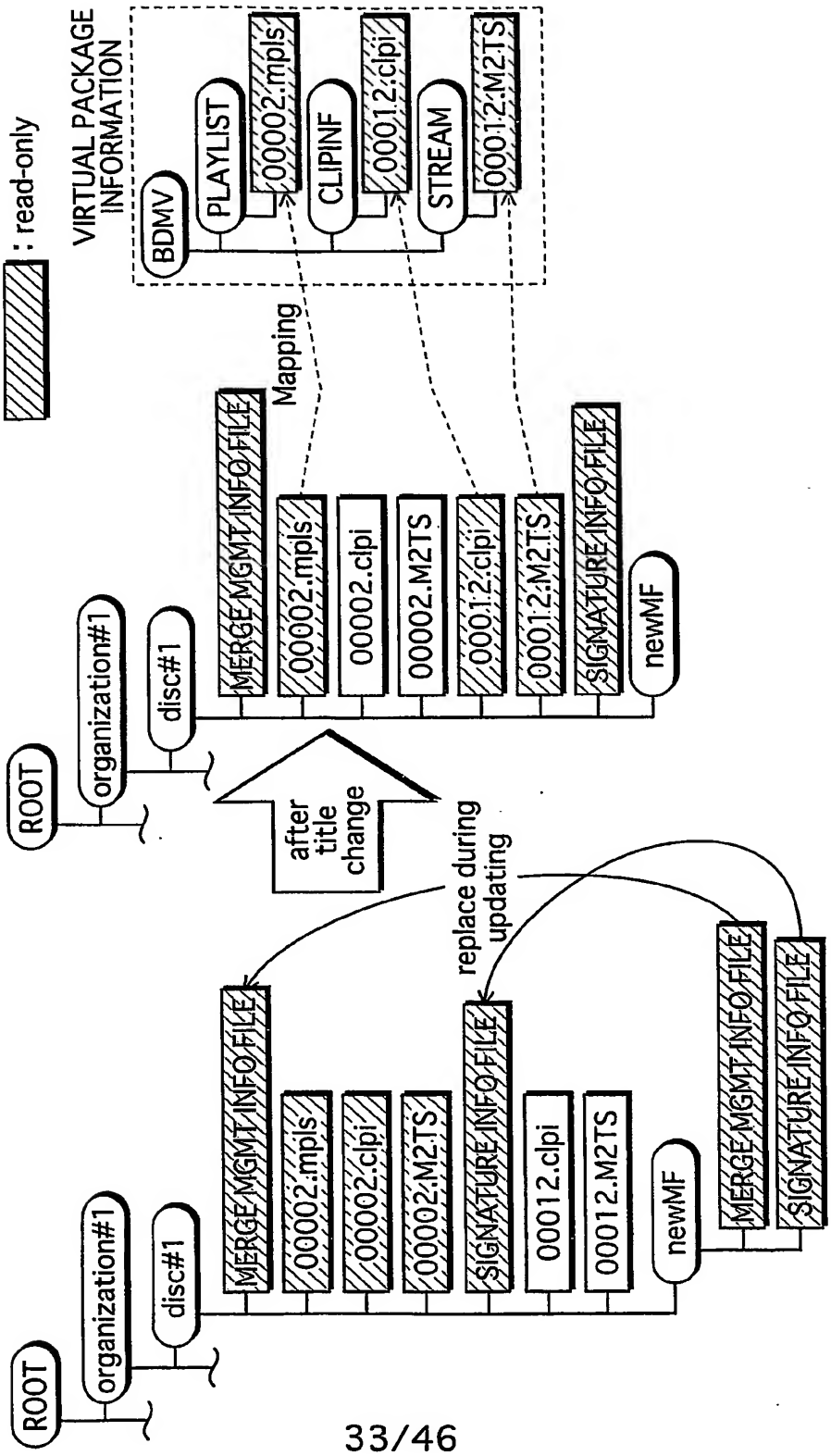

: read-only
VIRTUAL PACKAGE INFORMATION
BDMV
PLAYLIST
00002.mpls
CLIPINF
00012.clpi
STREAM
00012.M2TS
Mapping
ROOT
organization#1
disc#1
MERGE MGMT INFO FILE
00002.mpls
00002.clpi
00002.M2TS
00012.clpi
00012.M2TS
SIGNATURE INFO FILE
newMF
after title change
replace during updating
ROOT
organization#1
disc#1
MERGE MGMT INFO FILE
00002.mpls
00002.clpi
00002.M2TS
SIGNATURE INFO FILE
00012.clpi
00012.M2TS
newMF
MERGE MGMT INFO FILE
SIGNATURE INFO FILE

FIG.34

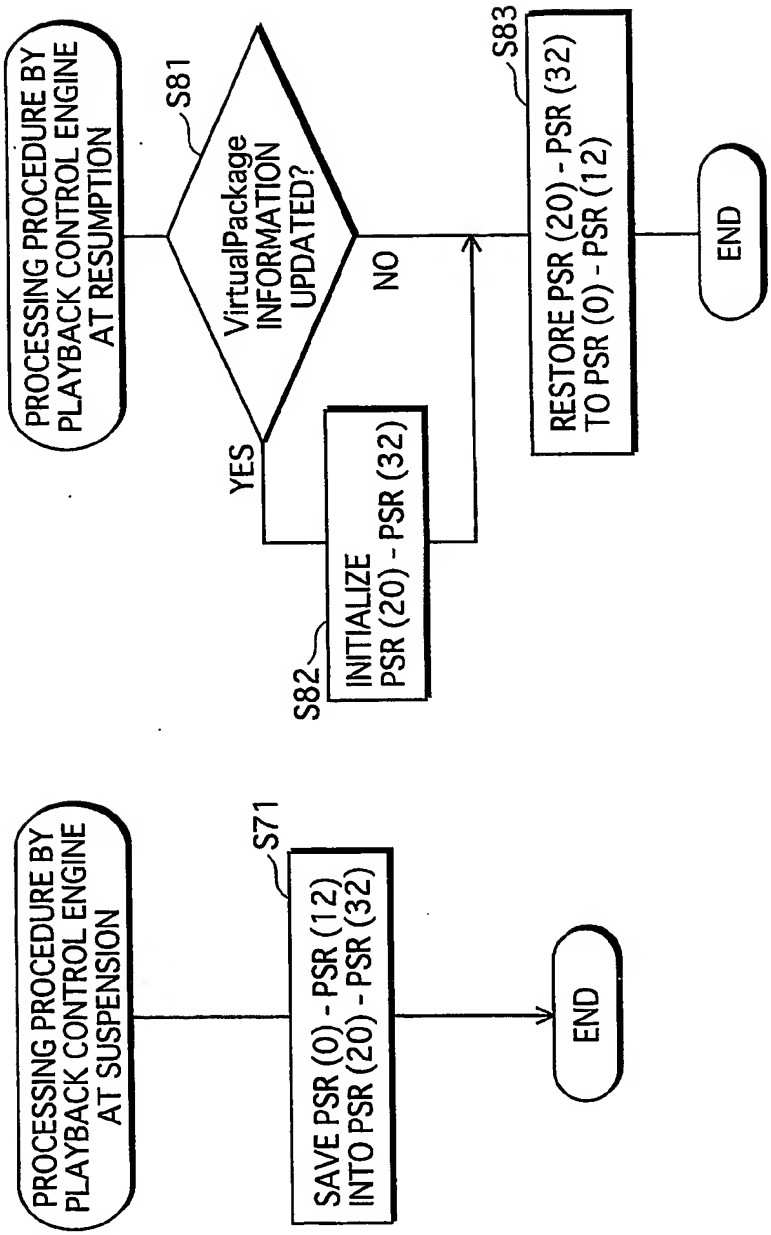

PROCESSING PROCEDURE BY PLAYBACK CONTROL ENGINE AT RESUMPTION
S81
VirtualPackage INFORMATION UPDATED?
YES
NO
S82
INITIALIZE PSR (20) - PSR (32)
S83
RESTORE PSR (20) - PSR (32) TO PSR (0) - PSR (12)
END
PROCESSING PROCEDURE BY PLAYBACK CONTROL ENGINE AT SUSPENSION
S71
SAVE PSR (0) - PSR (12) INTO PSR (20) - PSR (32)
END

FIG.35

MERGE MANAGEMENT INFORMATION

| Disc ID | MERGE TARGET DIRECTORY | UPDATED ON |
|---|---|---|
| disc #1 | /organization #1/disc #1/content #1 | 2004/01/01 |
| disc #1 | /organization #1/disc #1/content #2 | 2004/02/01 |
| disc #1 | - | 2004/03/01 |
| disc #1 | /organization #1/disc #1/content #3 | 2004/04/01 |

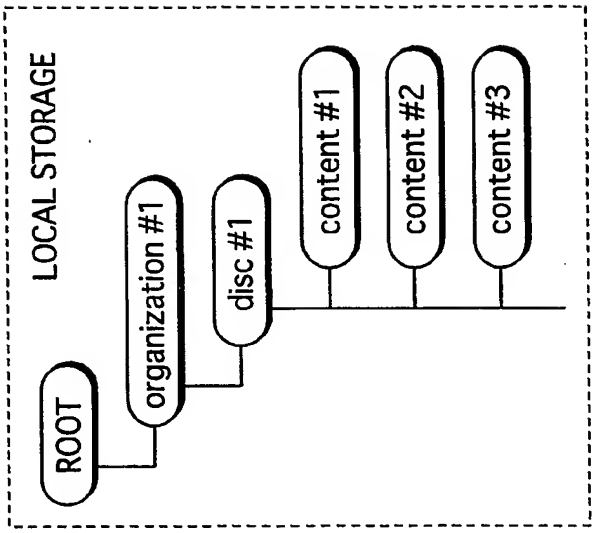


FIG.36

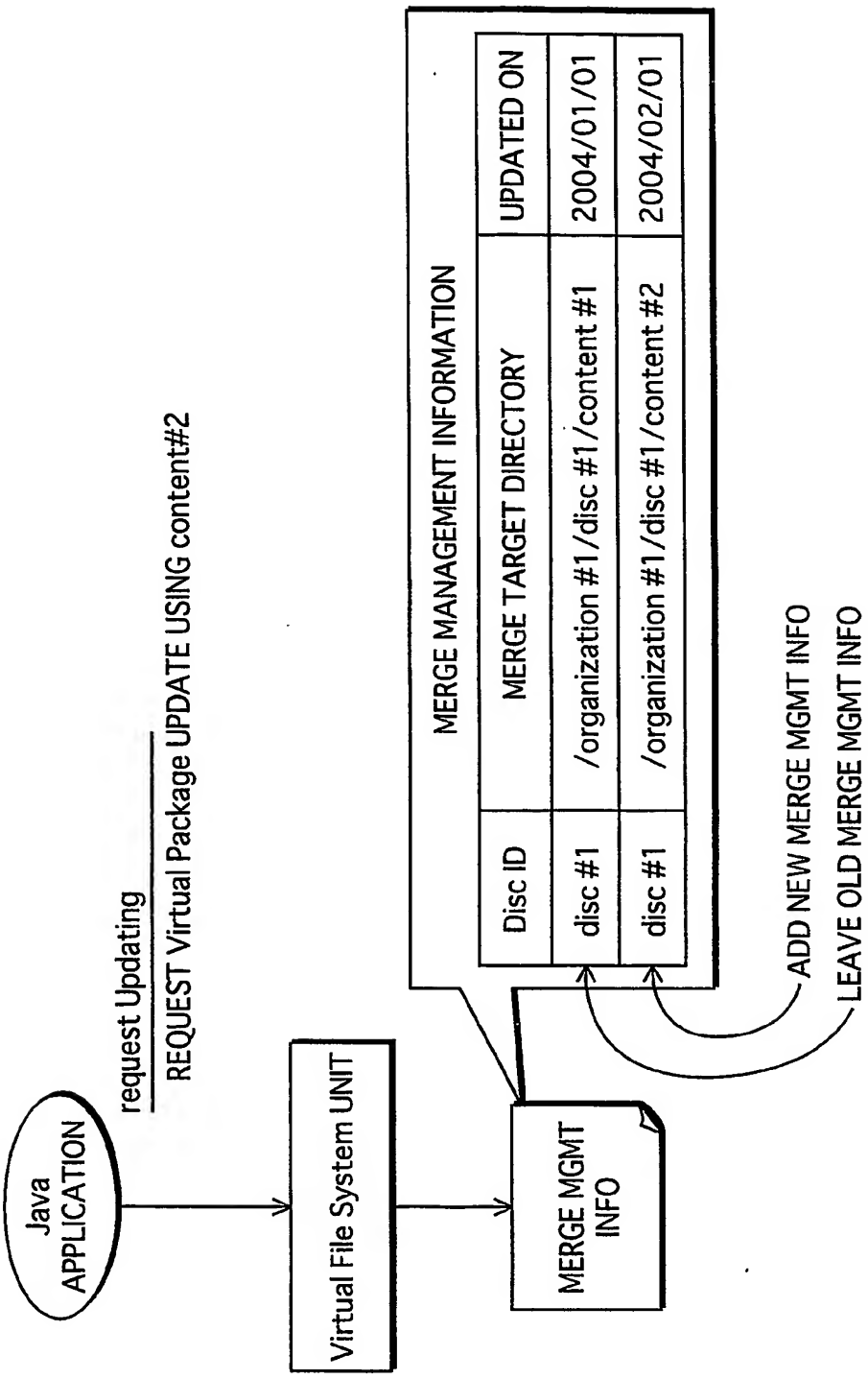

Java APPLICATION
request Updating
REQUEST Virtual Package UPDATE USING content#2
Virtual File System UNIT
MERGE MGMT INFO
MERGE MANAGEMENT INFORMATION
Disc ID
MERGE TARGET DIRECTORY
UPDATED ON
disc #1
/organization #1/disc #1/content #1
2004/01/01
disc #1
/organization #1/disc #1/content #2
2004/02/01
ADD NEW MERGE MGMT INFO
LEAVE OLD MERGE MGMT INFO

FIG.37

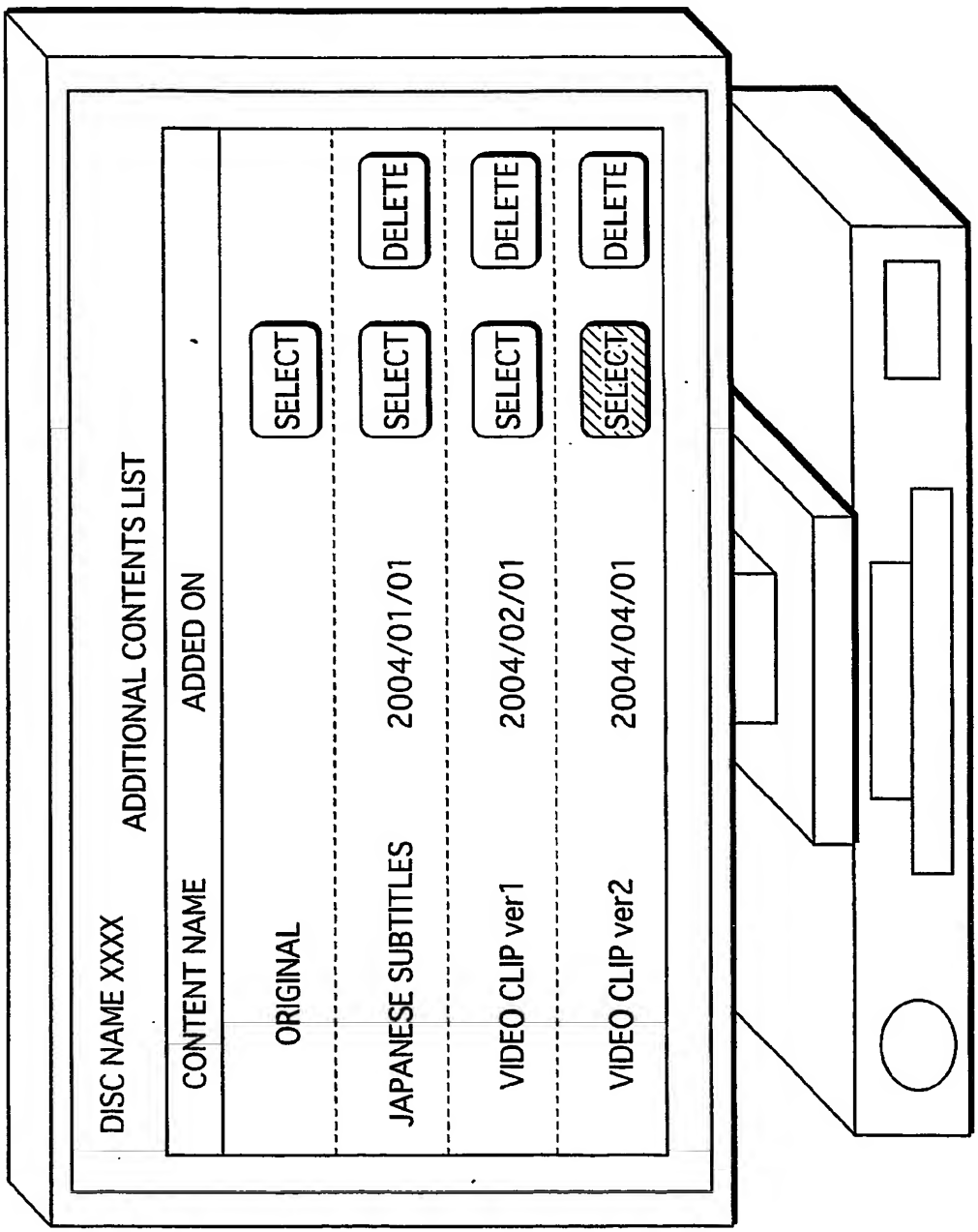

DISC NAME XXXX
ADDITIONAL CONTENTS LIST
CONTENT NAME
ADDED ON
ORIGINAL
SELECT
JAPANESE SUBTITLES
2004/01/01
SELECT
DELETE
VIDEO CLIP ver1
2004/02/01
SELECT
DELETE
VIDEO CLIP ver2
2004/04/01
SELECT
DELETE

FIG.38

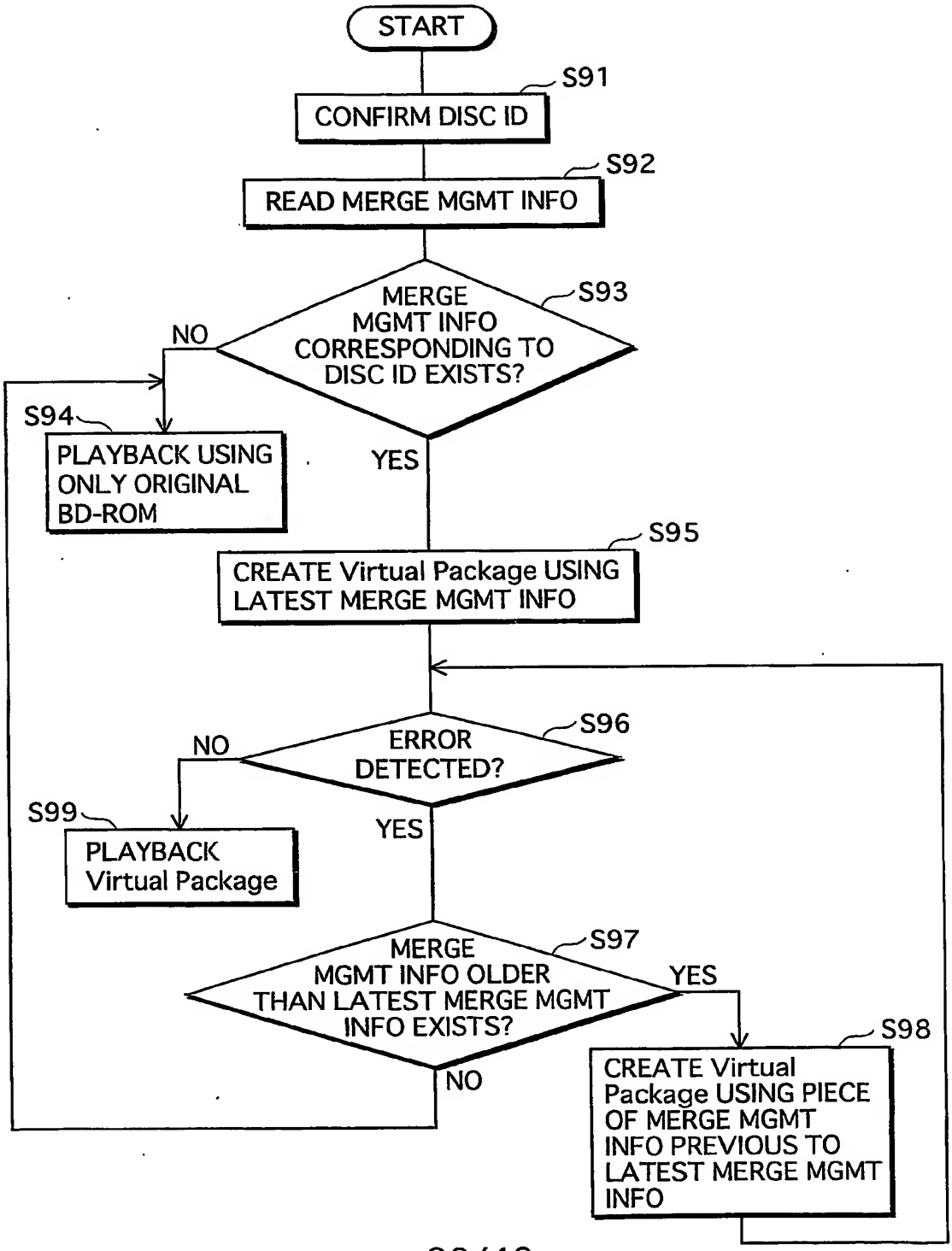

START
S91
CONFIRM DISC ID
S92
READ MERGE MGMT INFO
S93
MERGE MGMT INFO CORRESPONDING TO DISC ID EXISTS?
NO
YES
S94
PLAYBACK USING ONLY ORIGINAL BD-ROM
S95
CREATE Virtual Package USING LATEST MERGE MGMT INFO
S96
ERROR DETECTED?
NO
YES
S99
PLAYBACK Virtual Package
S97
MERGE MGMT INFO OLDER THAN LATEST MERGE MGMT INFO EXISTS?
YES
NO
S98
CREATE Virtual Package USING PIECE OF MERGE MGMT INFO PREVIOUS TO LATEST MERGE MGMT INFO

FIG.39

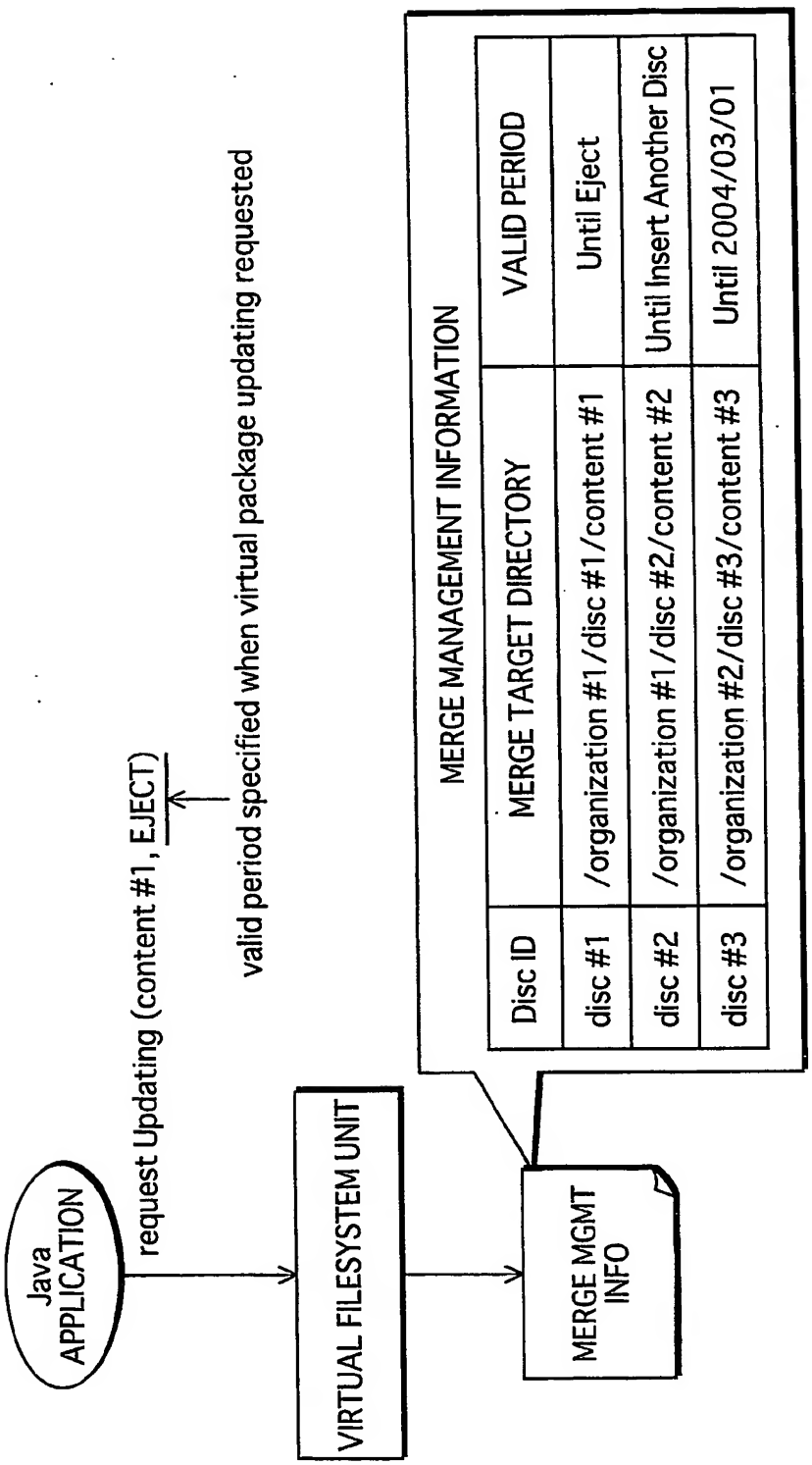

Java APPLICATION
request Updating (content #1, EJECT)
valid period specified when virtual package updating requested
VIRTUAL FILESYSTEM UNIT
MERGE MGMT INFO
MERGE MANAGEMENT INFORMATION
Disc ID
MERGE TARGET DIRECTORY
VALID PERIOD
disc #1
/organization #1/disc #1/content #1
Until Eject
disc #2
/organization #1/disc #2/content #2
Until Insert Another Disc
disc #3
/organization #2/disc #3/content #3
Until 2004/03/01

FIG.40

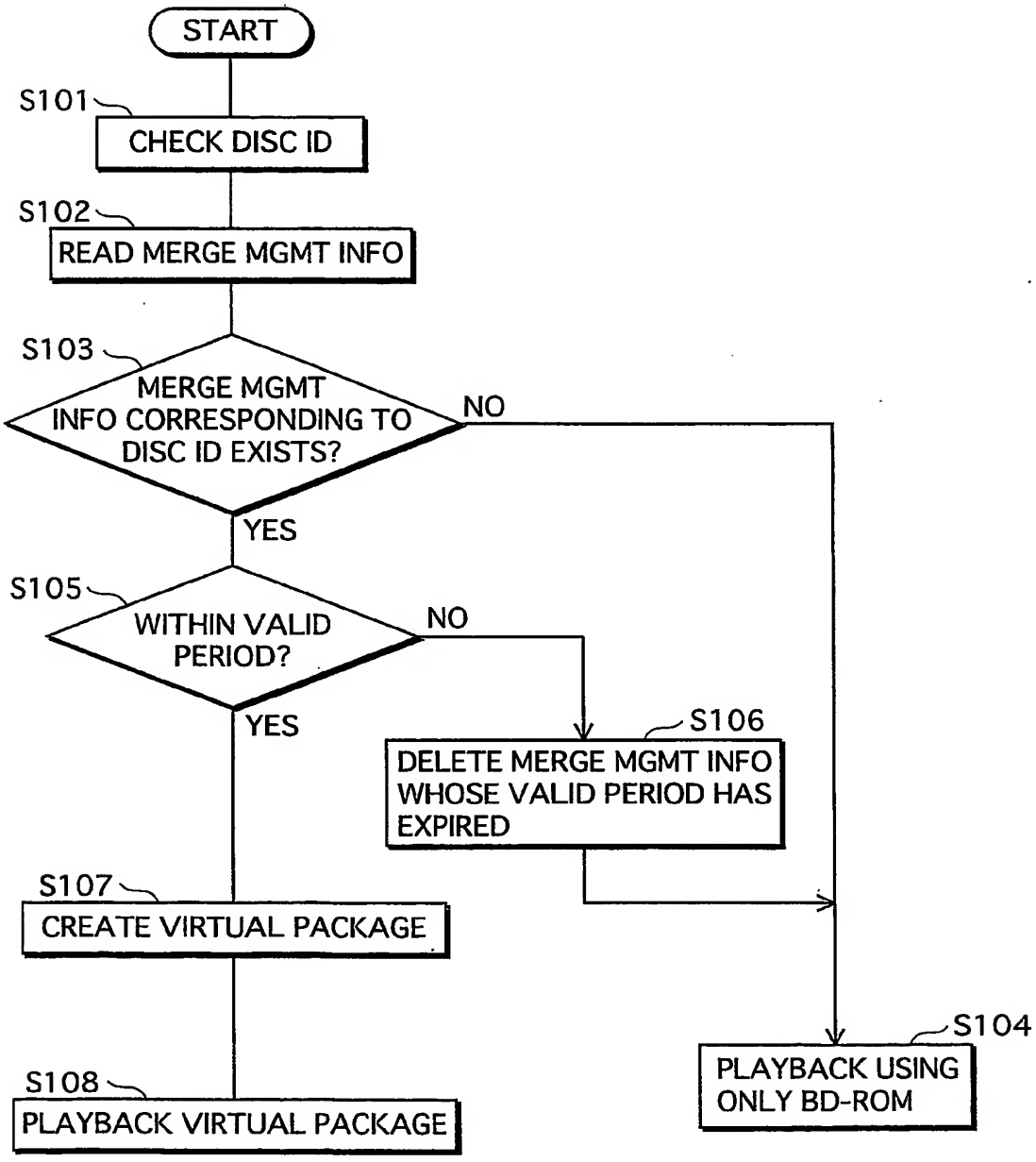

START
S101
CHECK DISC ID
S102
READ MERGE MGMT INFO
S103
MERGE MGMT INFO CORRESPONDING TO DISC ID EXISTS?
NO
YES
S105
WITHIN VALID PERIOD?
NO
YES
S106
DELETE MERGE MGMT INFO WHOSE VALID PERIOD HAS EXPIRED
S107
CREATE VIRTUAL PACKAGE
S108
PLAYBACK VIRTUAL PACKAGE
S104
PLAYBACK USING ONLY BD-ROM

FIG.41

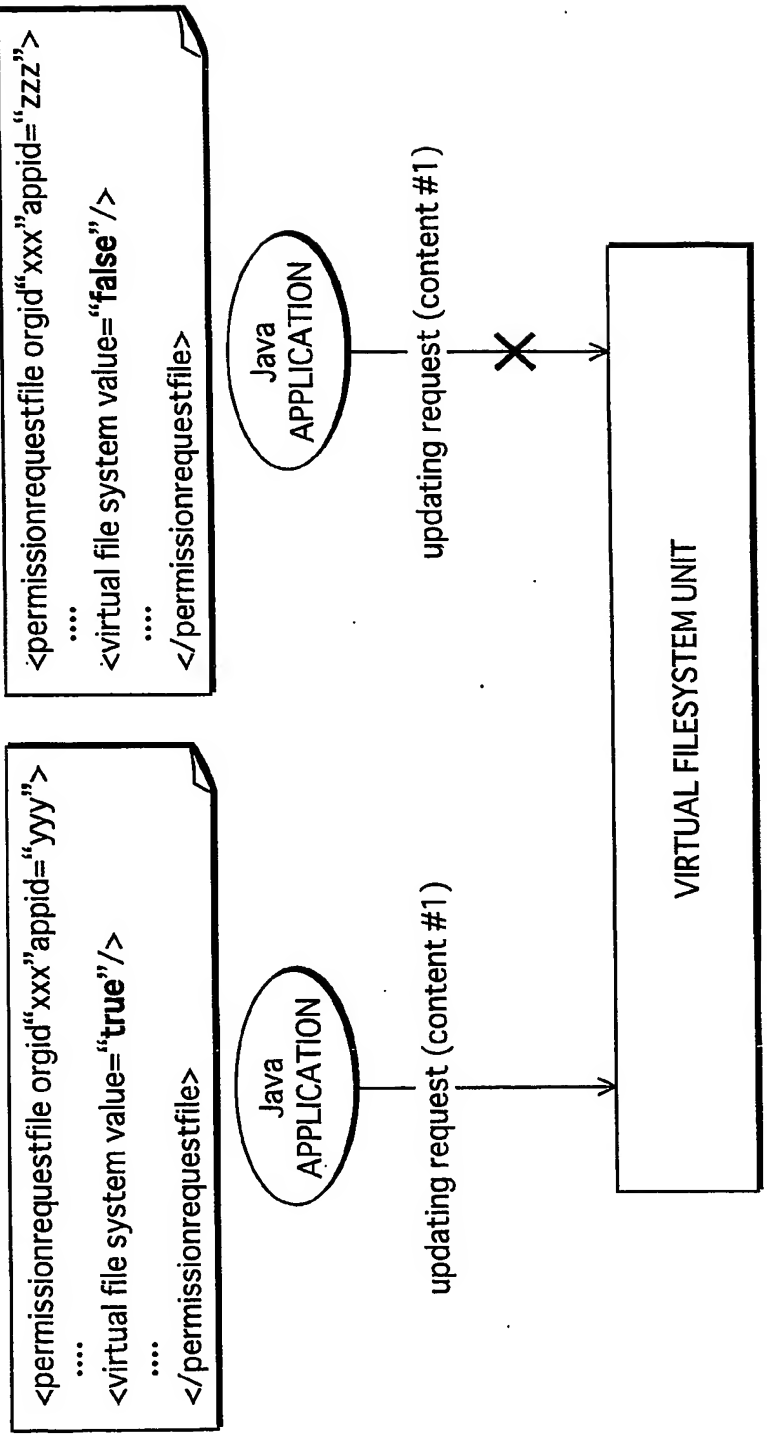

PERMISSION REQUEST FILE
<permissionrequestfile orgid="xxx"appid="yyy">
....
<virtual file system value="true"/>
....
</permissionrequestfile>
Java APPLICATION
updating request (content #1)
PERMISSION REQUEST FILE
<permissionrequestfile orgid="xxx"appid="zzz">
....
<virtual file system value="false"/>
....
</permissionrequestfile>
Java APPLICATION
updating request (content #1)
VIRTUAL FILESYSTEM UNIT

FIG.42

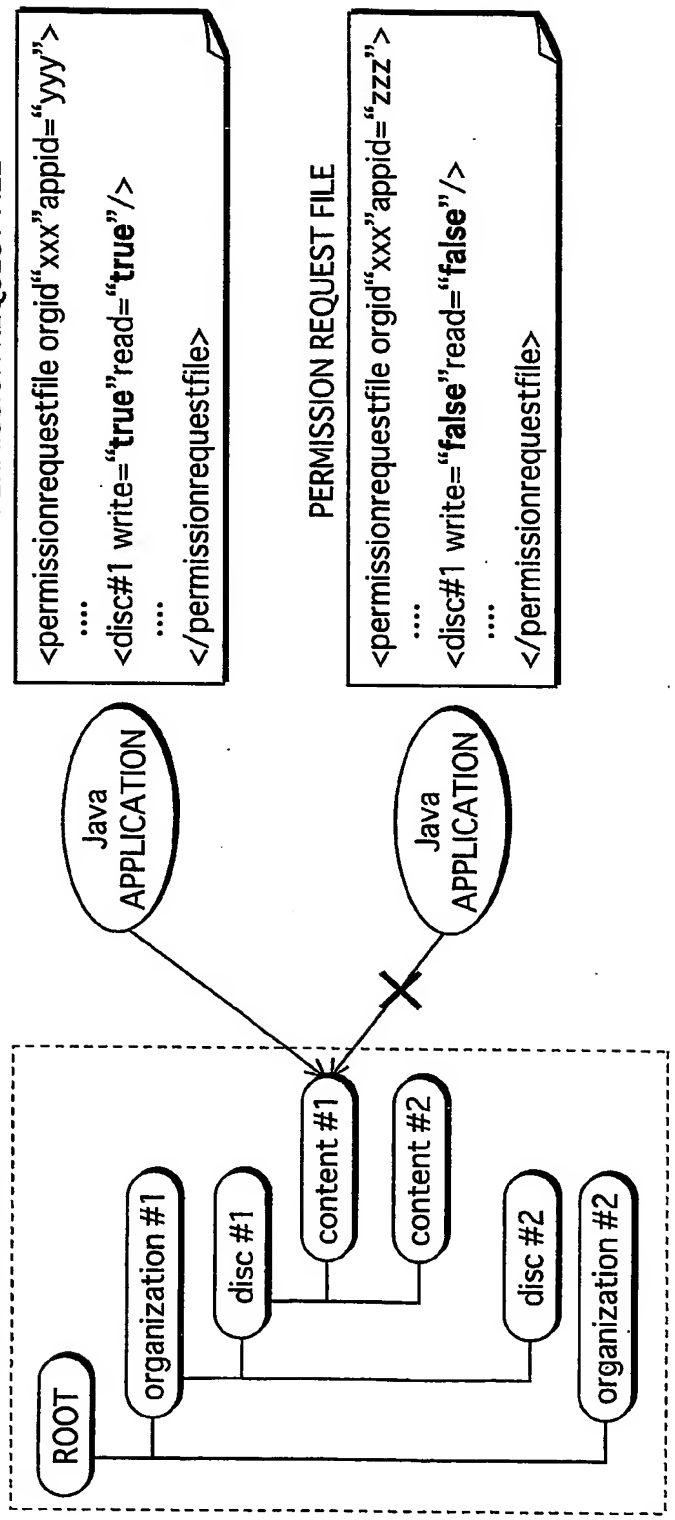

PERMISSION REQUEST FILE
<permissionrequestfile orgid"xxx"appid="yyy">
....
<disc#1 write="true"read="true"/>
....
</permissionrequestfile>
PERMISSION REQUEST FILE
<permissionrequestfile orgid"xxx"appid="zzz">
....
<disc#1 write="false"read="false"/>
....
</permissionrequestfile>
Java APPLICATION
Java APPLICATION
LOCAL STORAGE
ROOT
organization #1
disc #1
content #1
content #2
disc #2
organization #2

FIG.43

APPLICATION MANAGEMENT INFORMATION

| Title | APPL. ID | Title BOUND ATTR. |
|---|---|---|
| Title #1 | Java APPL #1 | Bound |
| | JJava APPL #2 | Unbound |
| Title #2 | Java APPL #2 | Bound |
| | Java APPL #3 | Unbound |
| Title #3 | Java APPL #3 | Bound |
| | Java APPL #4 | Bound |

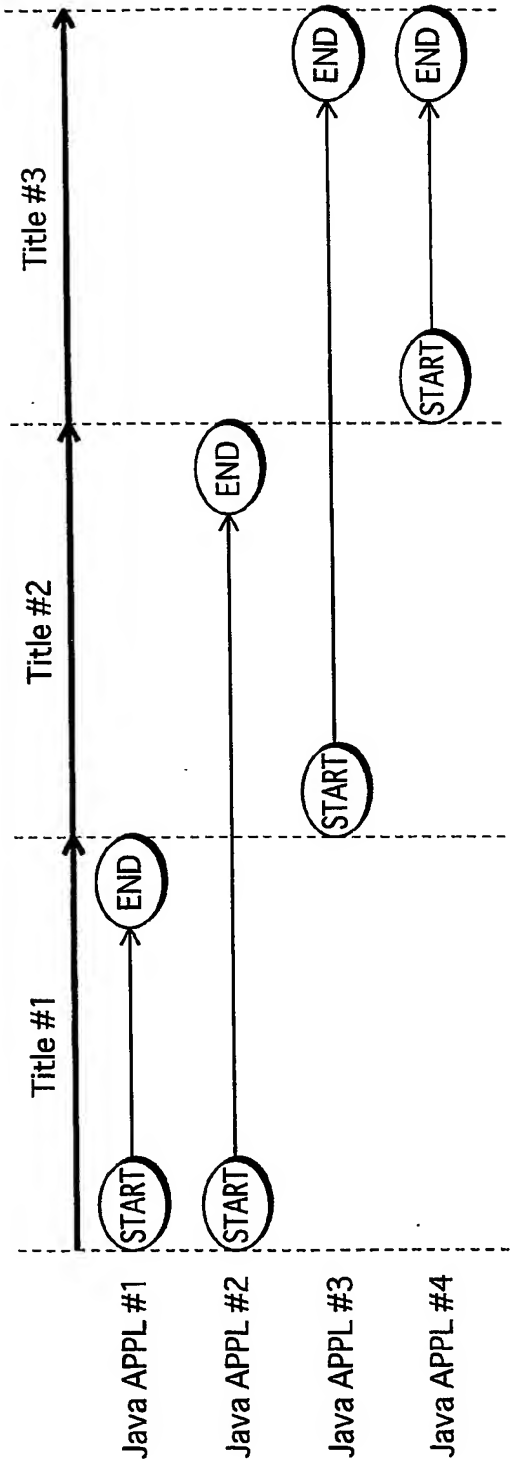


FIG.44

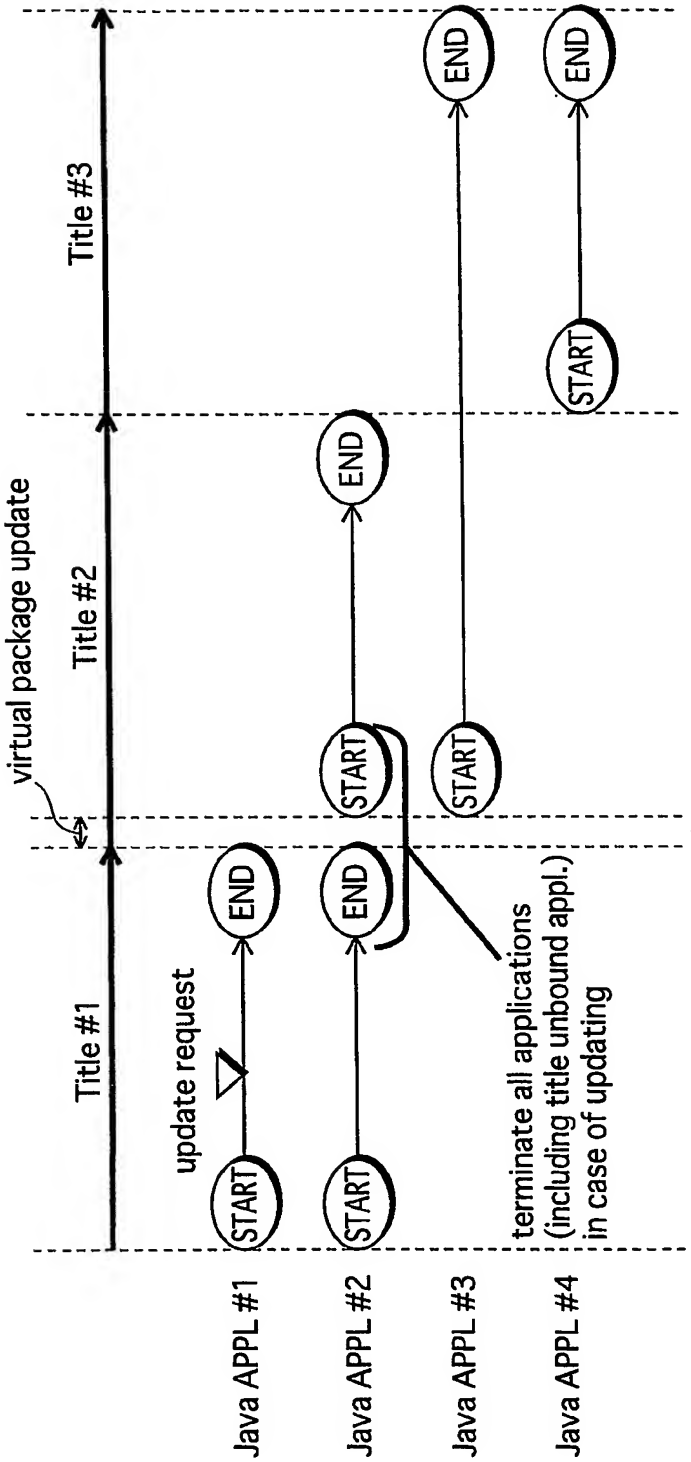

Title #1
Title #2
Title #3
virtual package update
update request
START
END
START
END
START
END
START
END
terminate all applications
(including title unbound appl.)
in case of updating
Java APPL #1
Java APPL #2
Java APPL #3
Java APPL #4

FIG.45

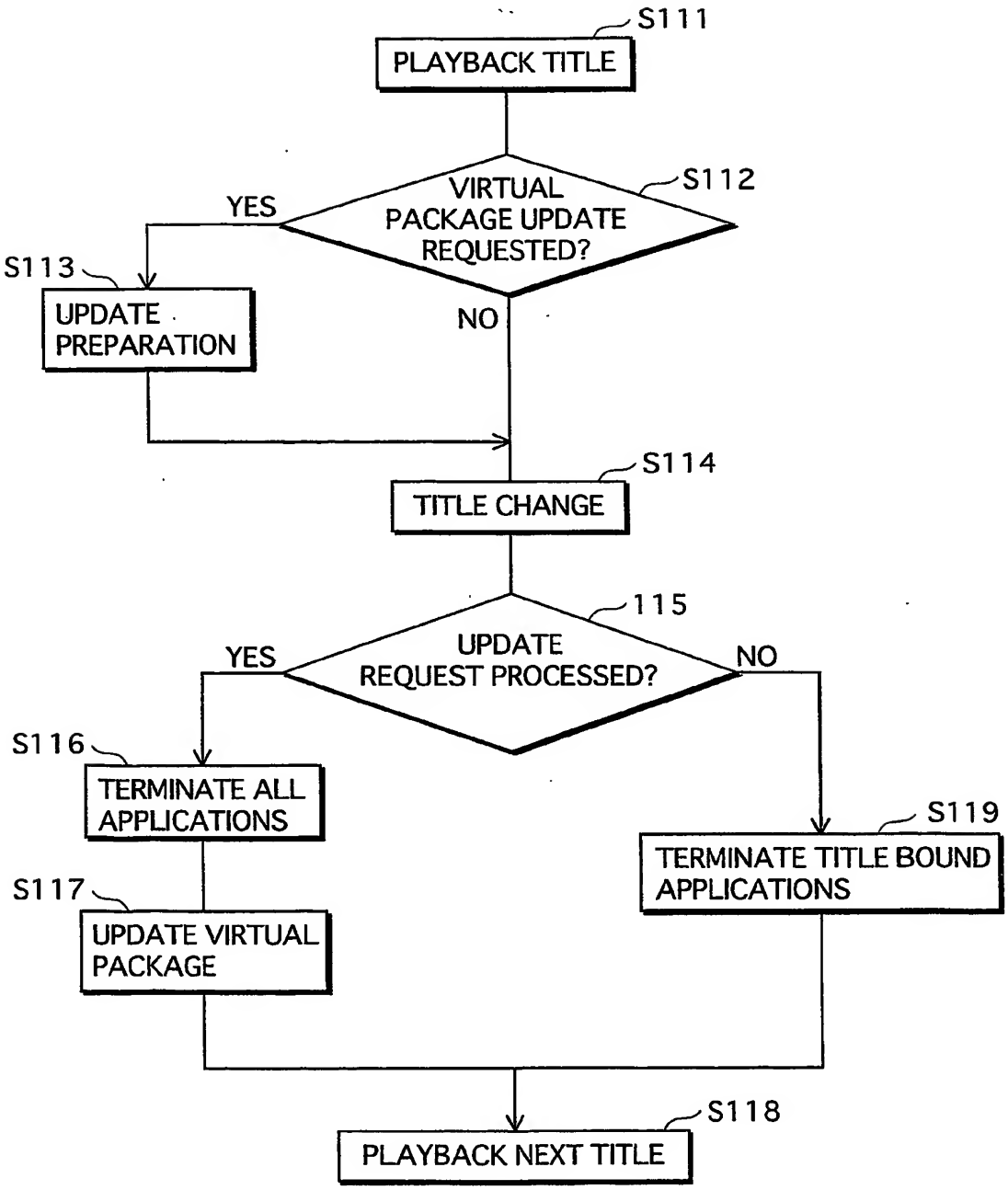
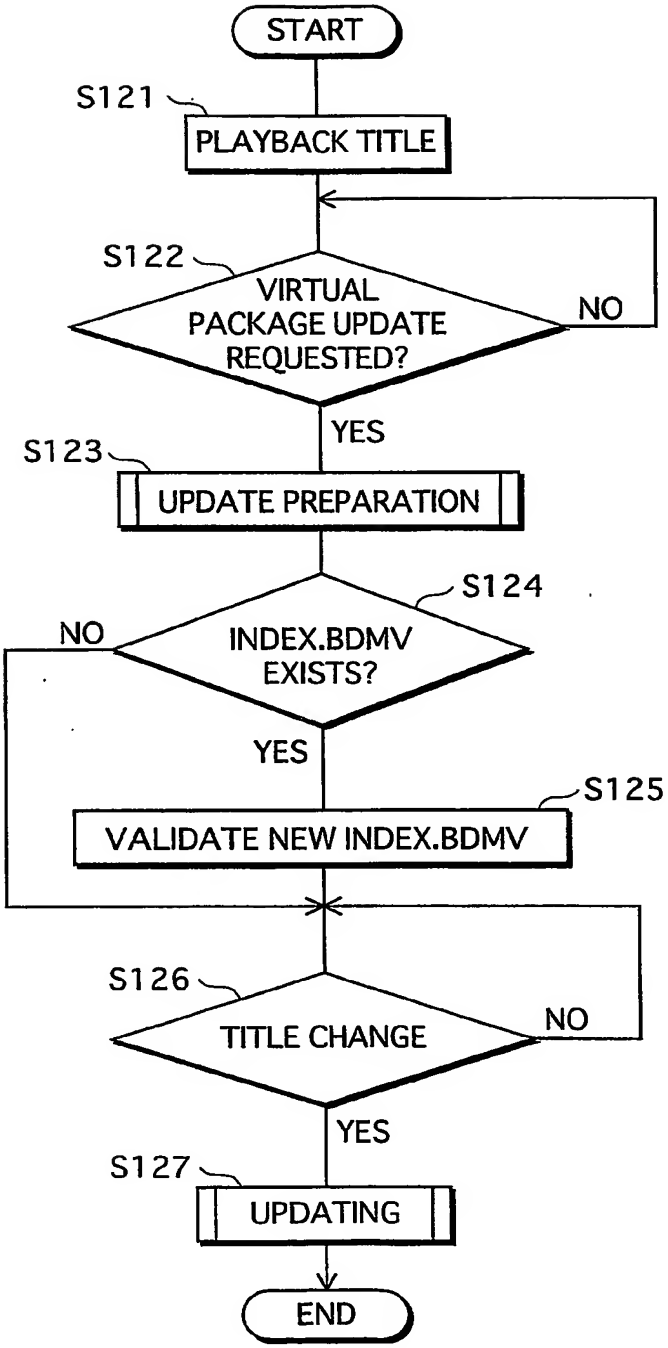

S111
PLAYBACK TITLE
VIRTUAL PACKAGE UPDATE REQUESTED?
S112
YES
NO
S113
UPDATE PREPARATION
S114
TITLE CHANGE
115
UPDATE REQUEST PROCESSED?
YES
NO
S116
TERMINATE ALL APPLICATIONS
S117
UPDATE VIRTUAL PACKAGE
S119
TERMINATE TITLE BOUND APPLICATIONS
S118
PLAYBACK NEXT TITLE

FIG.46


START
S121
PLAYBACK TITLE
S122
VIRTUAL PACKAGE UPDATE REQUESTED?
NO
YES
S123
UPDATE PREPARATION
S124
INDEX.BDMV EXISTS?
NO
YES
S125
VALIDATE NEW INDEX.BDMV
S126
TITLE CHANGE
NO
YES
S127
UPDATING
END